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THE NATIONAL GEOGRAPHIC MAGAZINE

JUNE, 1910

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PUBLISHED BY THE
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HUBBARD MEMORIAL HALL
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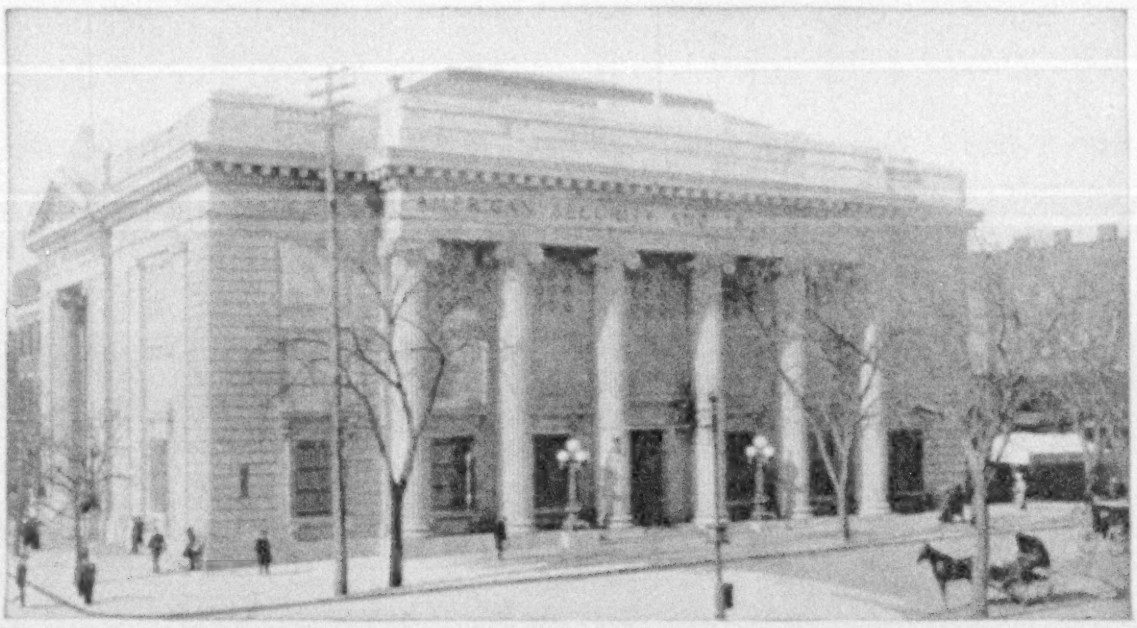

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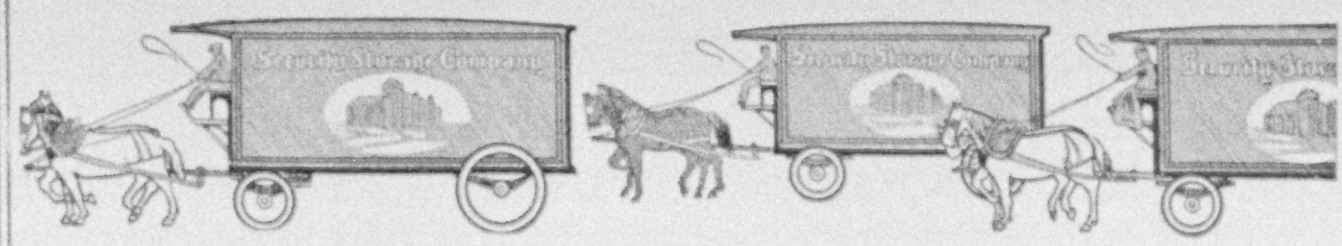

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THE NATIONAL GEOGRAPHIC MAGAZINE

SOME TRAMPS ACROSS THE GLACIERS AND SNOWFIELDS OF BRITISH COLUMBIA

BY HOWARD PALMER

Illustrations from Photographs by the Author

BRITISH COLUMBIA is preëminently a land of mountains. From its eastern boundary—the continental divide of the Rockies—to the rolling Pacific, 500 miles away on the west, the traveler is kept in constant bewilderment by the endless succession of ranges, peak piled on peak and glacier on glacier.

Gaze upward from any forest-filled valley and the gleam from some snow-cap will dazzle you through the tree-tops. Follow that valley to its head and a glacier tongue will stretch downward, luring you still higher to the frigid wonders above.

Other natural features demand admiration—dark gorges, roaring torrents, spraying cataracts, beetling cliffs, dense forests, glorious wild flowers—but the dominant note above all is glistening ice in pinnacle and crevasse.

The climax of this grandeur is attained in the Selkirk Range, whose highest summits indent the clouds 11,000 feet above tide-water. From its rugged shoulders more glaciers hang than are to be counted in all the Alps. Even a native Swiss has acknowledged that the Selkirks "surpass our mountains in labyrinthine organization, in the production of primeval thickets, and the vast number of glaciers."* One can count as many as a hundred of these from even one of the minor summits.

To reach this mountain wonderland there is only one way: take the main line of the Canadian Pacific Railroad and alight at Glacier Station. You are then very nearly at the summit of the range, with splendid peaks and glaciers on every side.

One of the finest of these, the "Great Illecillewaet," pours seemingly out of the sky only two miles away—a short hour's trip from the Pullman car. Another, the Asulkan Glacier, four miles to the south, may be explored by way of an excellent trail leading up through a flower-strewn valley of the same name. At the heads of both these glaciers lie magnificent fields of permanent snow, the one above the Illecillewaet being especially remarkable. Here, at an altitude of 8,500 feet, rounded billows of spotless névé stretch away to the south for 15 square miles—an inexhaustible reservoir for the rifted ice-streams which flow from it at either extremity.

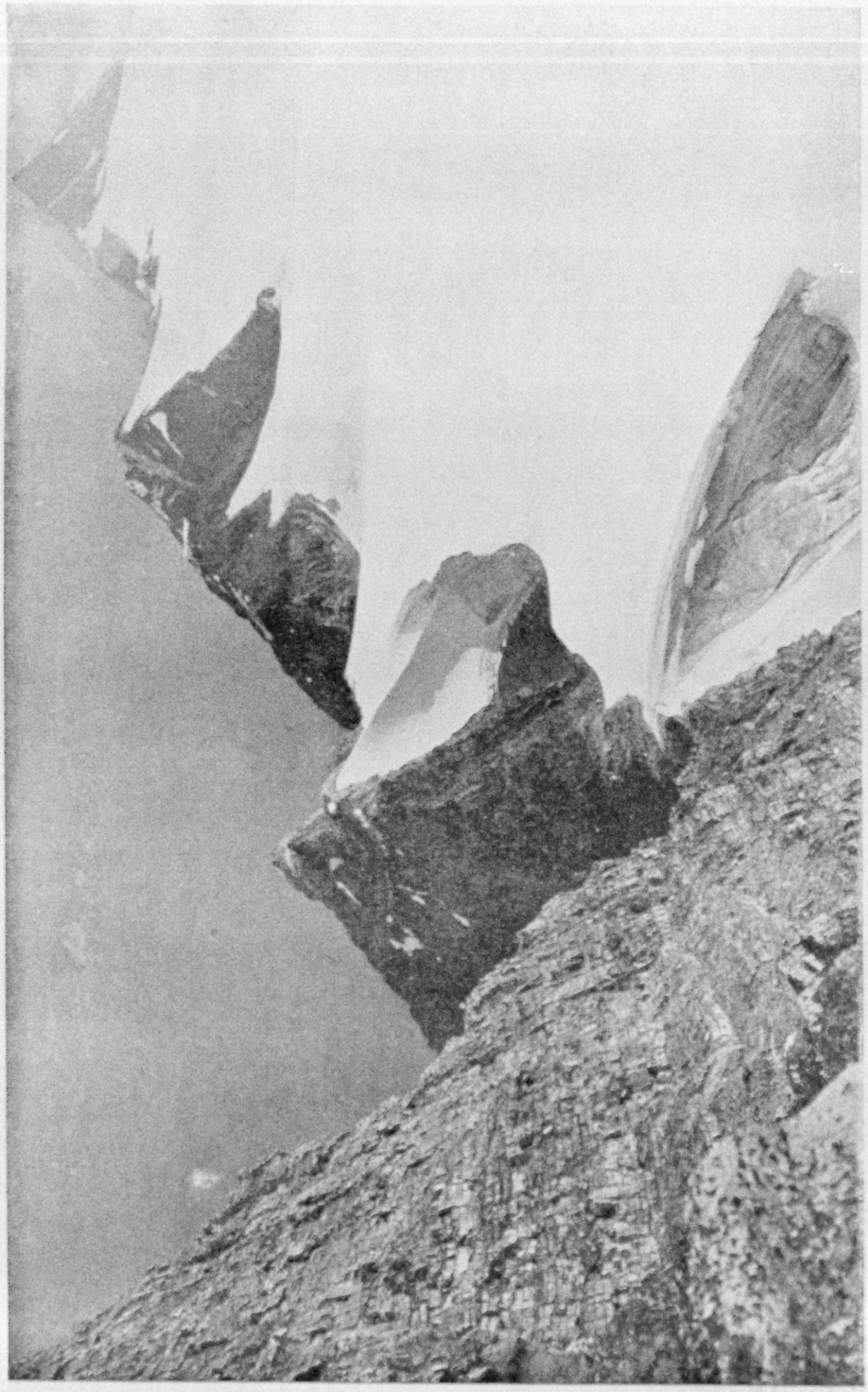
* E. Huber in Schweizer Alpenclub Jahrbuch, 1890-1891, p. 278.

ILLECILLEWAET GLACIER AND ASULKAN PASS: THE GLACIER MOVES NEARLY ONE FOOT EACH DAY (SEE PAGE 461)

"Here, at an altitude of 8,500 feet, rounded billows of spotless névé stretch away to the south for 15 square miles—an inexhaustible reservoir for the rifted ice-streams which flow from it at either extremity."

ILLECILLEWAET NÉVÉ: THE DEVILLE NÉVÉ APPEARS IN THE BACKGROUND, RIGHT OF CENTER

This excellent glacial pass forms one of the few well-defined ways across the long rampart of the Selkirks, though it is hardly practicable for any but mountaineers



EASTERN ESCARPMENT OF ILLECILLEWAET NÉVÉ FROM TERMINAL PEAK

For the past two summers the writer has had the good fortune to spend his vacations in wandering through this Selkirk wilderness. In company with two friends, Prof. F. W. D. Holway and Mr Frederick K. Butters, of Minneapolis, he has "packed" all necessities for extended trips across the passes and glaciers, pushing even into previously unvisited portions of the range.

GEIKIE GLACIER

One of our early excursions was a visit to the Geikie Glacier, which drains the southwestern portion of the Illecillewaet névé as the "Great Illecillewaet" does on the north. The trip promised to be unusually interesting, as the glacier had been traversed only once previously. That, however, was made along its southern margin, while our plan was to keep to the ice itself as much as conditions allowed.

Starting from Glacier, we "trailed it" up the Asulkan Valley and over the pass at its head, 3,700 feet above the hotel, then down 2,800 feet into the further valley, where our glacier lay. Camp was set up near its lower ice-fall shown in the photographs.

This ice-fall was especially remarkable for the way in which the pure white ice, upon reaching the sharp decline, broke up into long, flat-topped ridges or ranks like huge sections of some ancient castle's wall, extending nearly across the glacier. Lower down these were consolidated by the pressure into deep wave-like channels, gradually smoothing out toward the tongue.

Through one of these convenient transverse grooves we crossed the glacier a day or two later. Then, skirting along the steep rocks of its northern margin, we surmounted the fall and took to the smoother ice higher up. After passing over a broad terrace we approached the highest fall of all, where the tremendous mass of ice tumbles down from the névé in a hopeless confusion of splintered séracs.

Glittering towers of ice the size of a city building, grotesquely fashioned and tilted at impossible angles, had been reared aloft by the mighty force from above until the mile of crescent skyline resembled a huge wave frozen by some mystic power as it breaks into thousands of splashes.

It was this great chaos of ice that turned back the Rev. W. S. Green, pioneer explorer of the Selkirks, in 1889. Gazing down upon it from the Illecillewaet névé, he describes the scene as follows: "In its bottom (valley of Fish Creek) a fine glacier wound its sinuous course till lost to sight beyond a bend. Grand precipices flanked it on either hand, and piles of avalanched snow lay half covering the crevasses which were in a regular network over its entire surface. Cautiously we crossed a few snow bridges, but it became too evident that this was no road for the sledges."*

After admiring the impressive spectacle for some time we turned back, for the sun was well down in the west and our position not exactly suitable for a bivouac. We followed our route of ascent to the middle terrace, and then, crossing this, continued to camp along the southern bank.

On the way rather emphatic proof of the glacier's movement was afforded us. During a halt by a tiny stream trickling down a crevice in the ice, one of the party knelt down to drink. His surprise may be imagined on seeing the crack open slightly and the whole stream disappear bodily into its depths.

The movements of the Geikie Glacier, as far as the writer is aware, have never been measured. In all probability they are comparatively small, for the stream, as above mentioned, contains a sharp bend with closely constricting walls, which would greatly retard the motion by their excessive friction.

The Illecillewaet and Asulkan glaciers, however, have been carefully studied, the former from as early as 1888, when the Rev. W. S. Green set out a line of stakes across the ice to measure its rate of flow. His maximum result was 12 feet in 20

* Proceedings of the Royal Geographical Society, vol. XI, 1889, p. 160.

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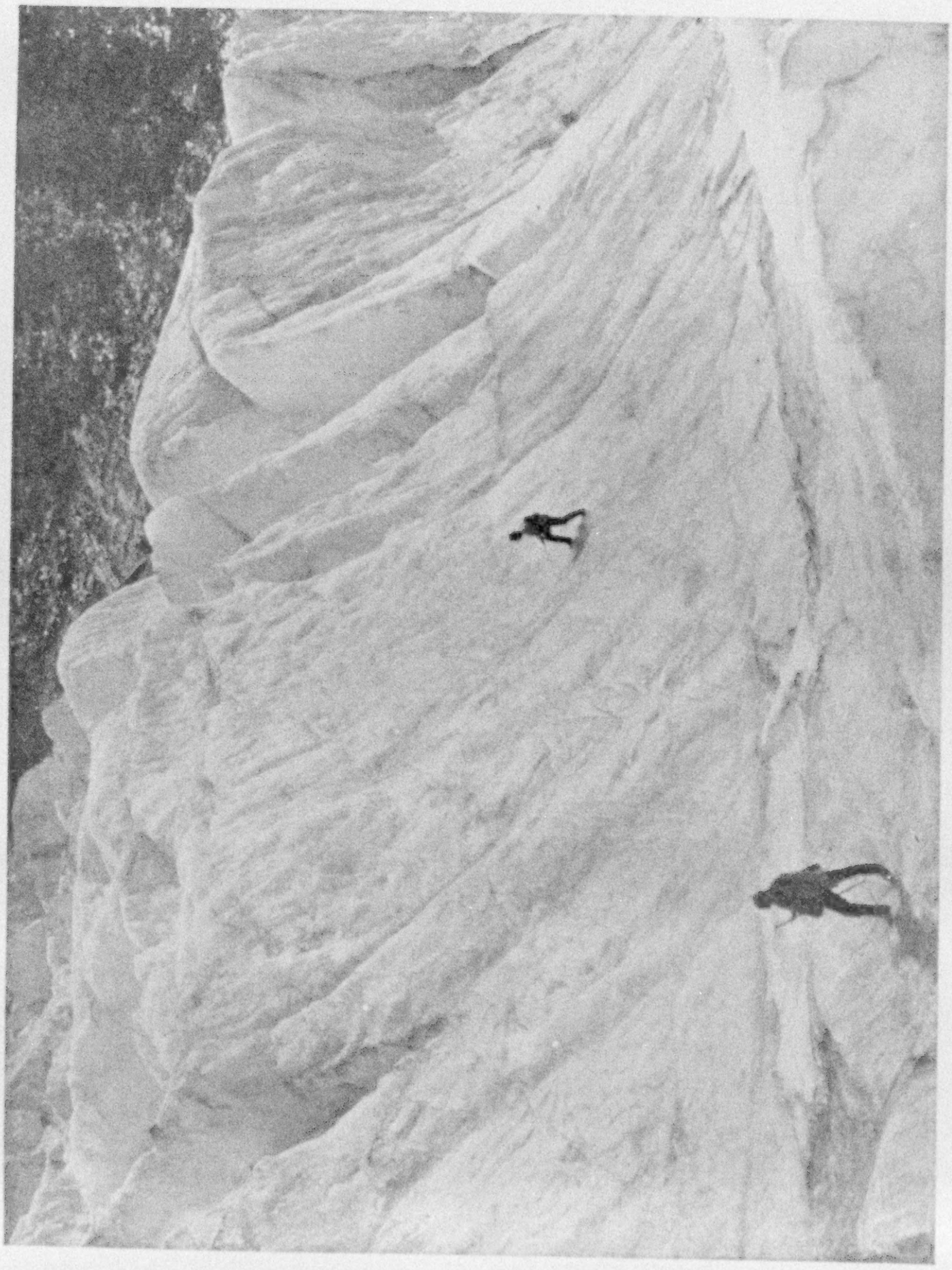
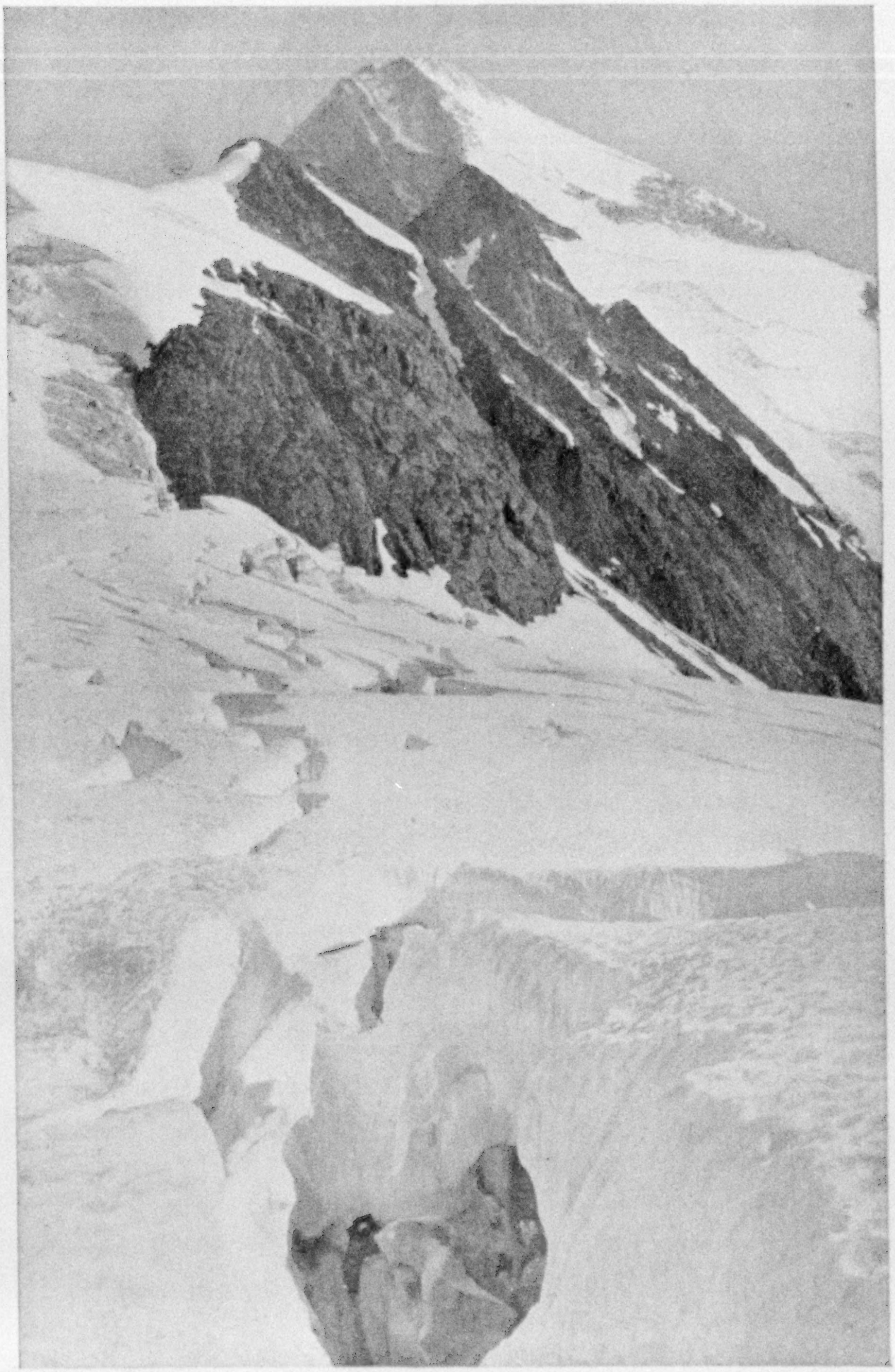
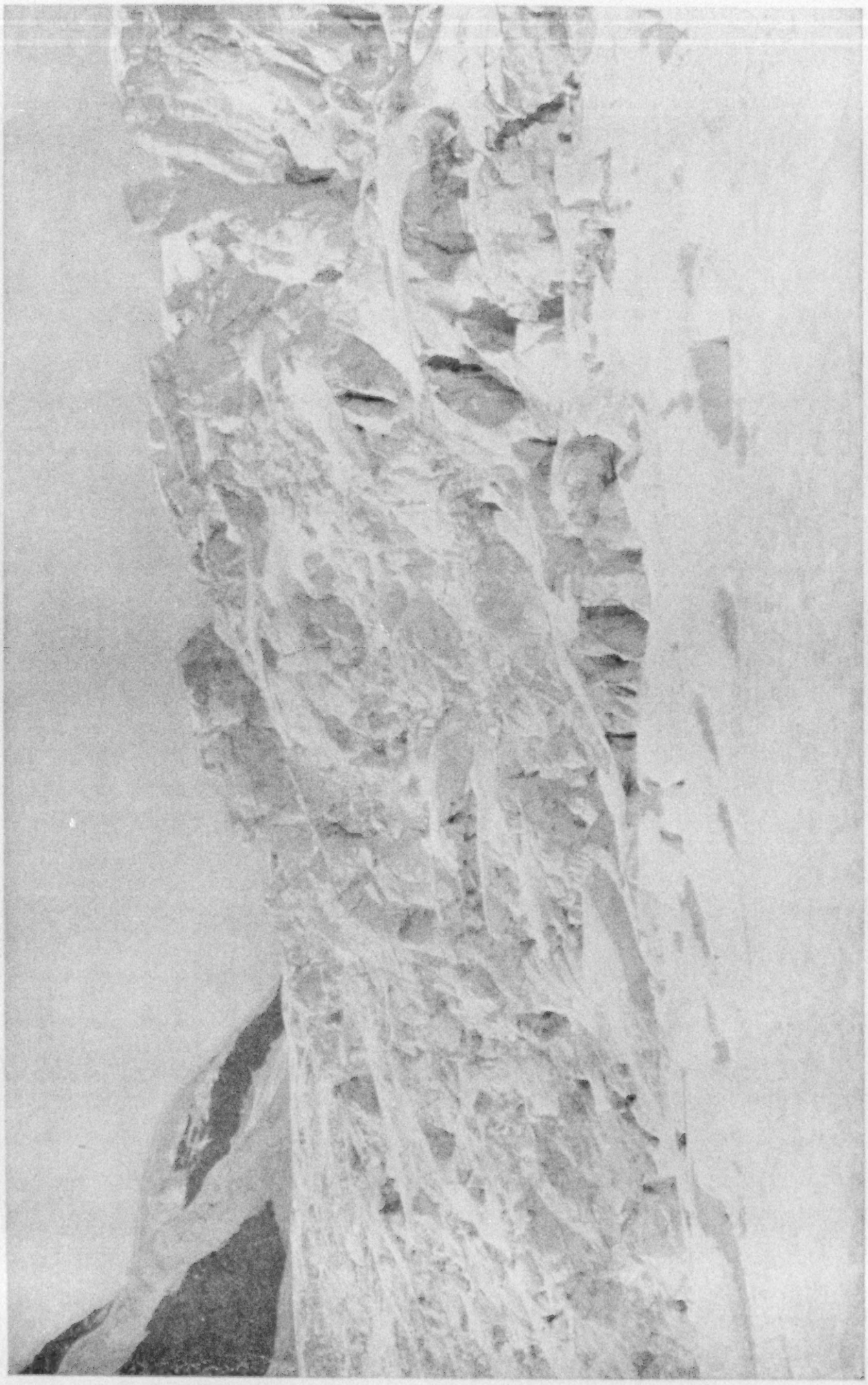


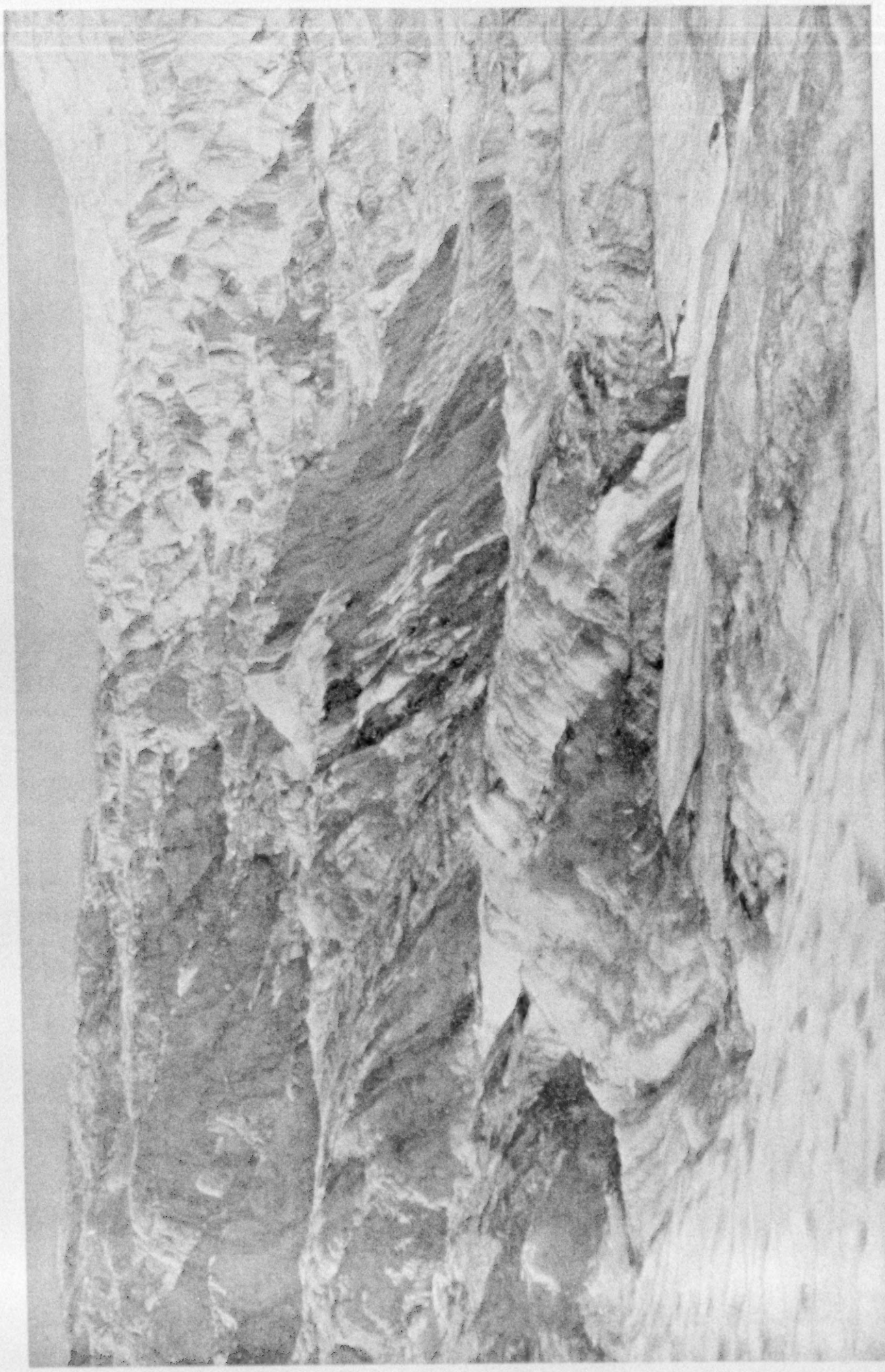
CROSSING GEIKIE GLACIER



CREVASSES IN GEIKIE GLACIER; MOUNT FOX BEHIND (10,576 FEET)

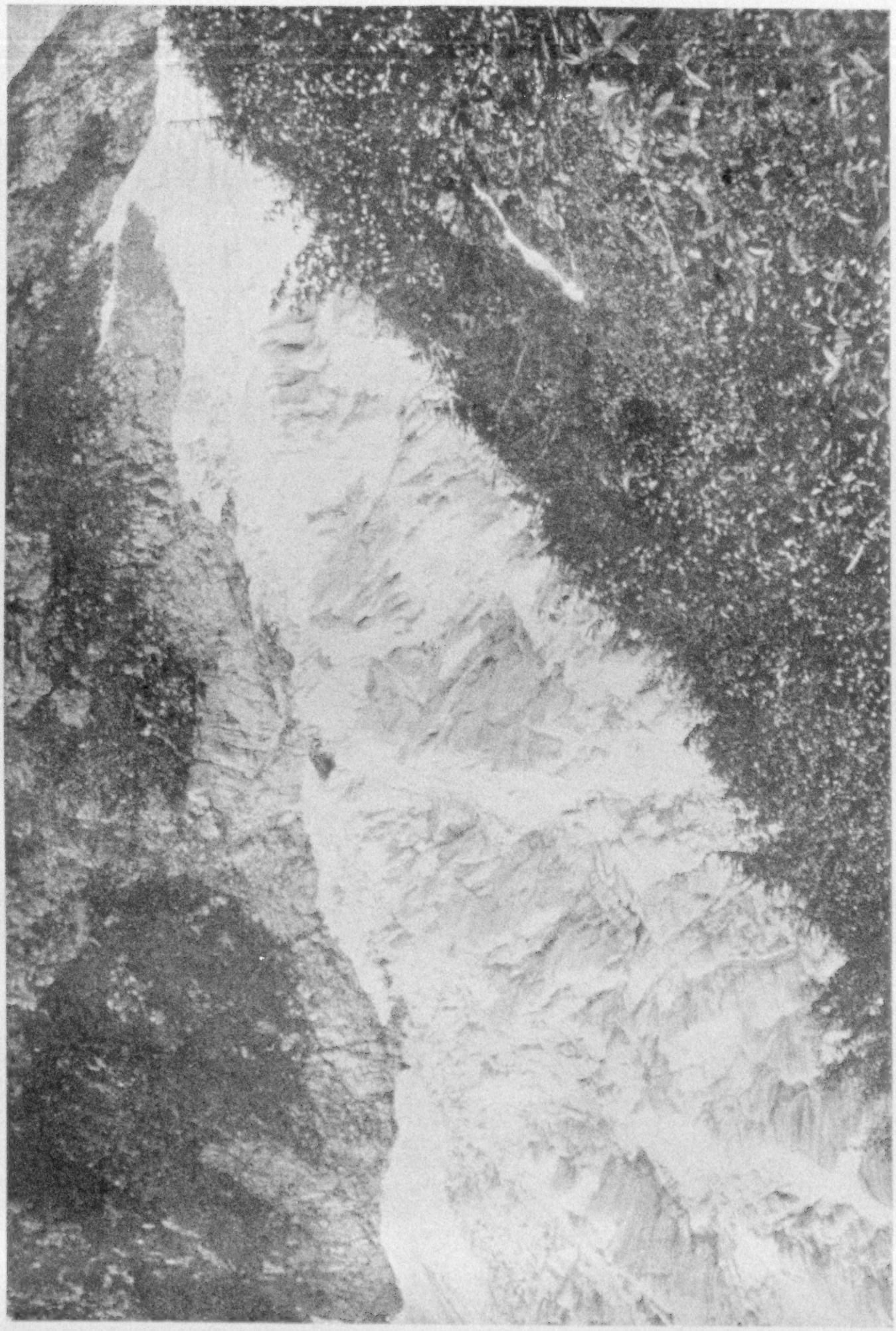


UPPER ICEFALL OF GEIKIE GLACIER

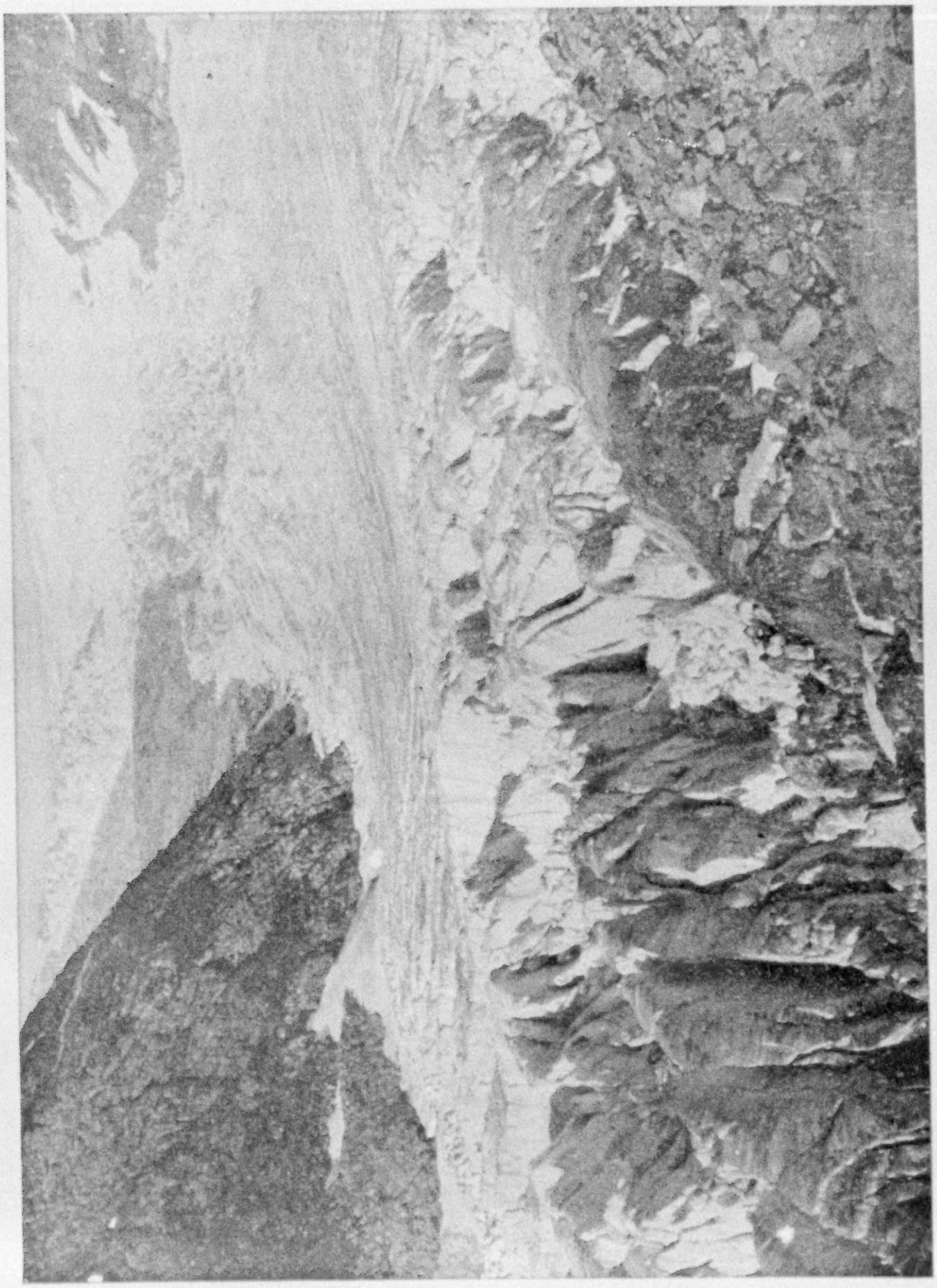


MIDDLE ICEFALL OF GEIKIE GLACIER

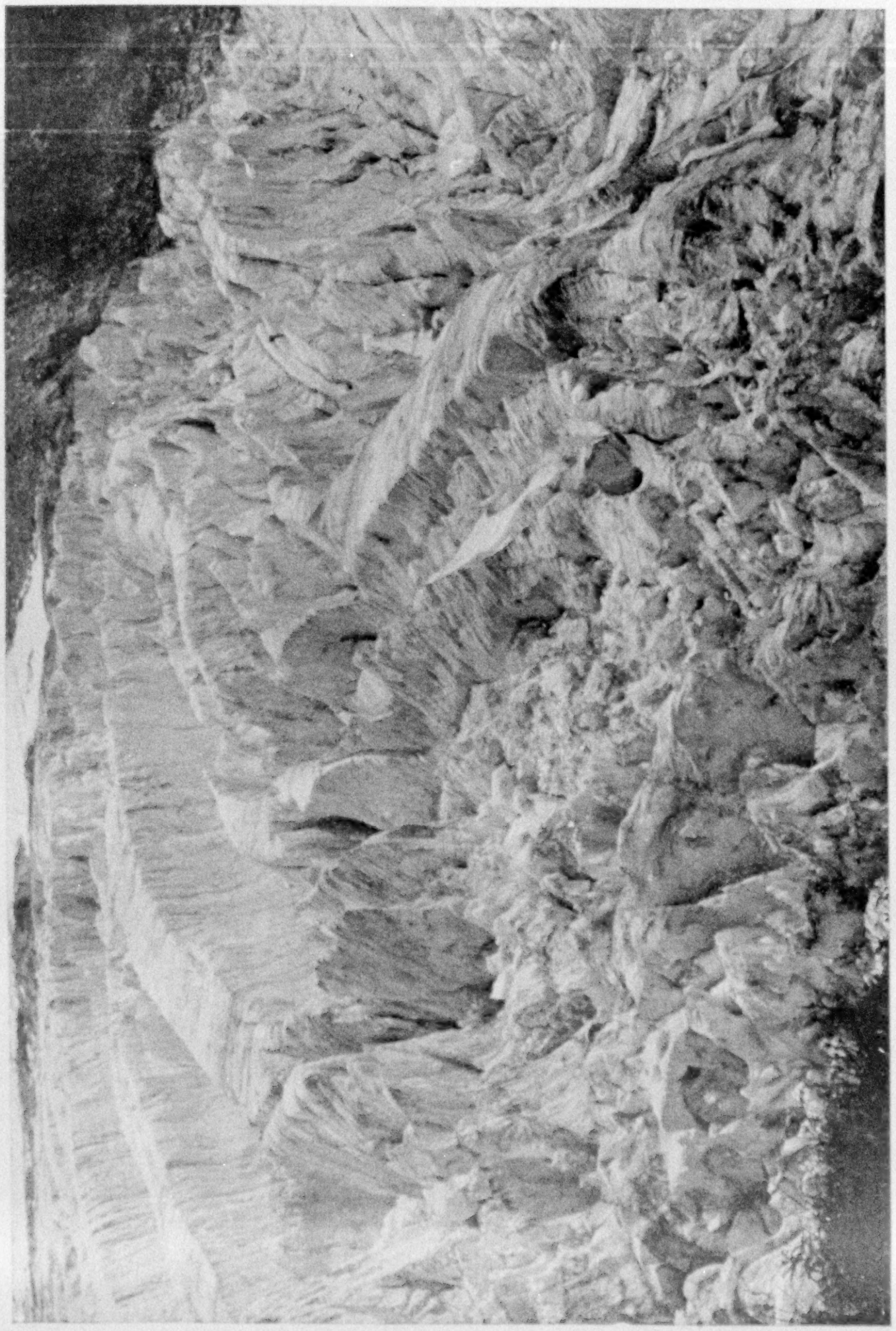
"We unanimously decided that the Geikie Glacier was the finest we had seen in the Selkirks. Longer there are and greater, but for purity, variety of ice formations, and general interest the Geikie is unsurpassed"



LOWER ICEFALL OF GEIKIE GLACIER FROM SLOPES ON SOUTH SIDE OF VALLEY



GENERAL VIEW OF CEIKIE GLACIER ABOVE LOWER ICEFALL



DEEP, WAVELIKE CHANNELS OF THE LOWER ICEFALL OF GEIKIE GLACIER (SEE PAGE 461)

days—a rate of nearly a foot and three-quarters per day.

From later measurements of this glacier by George and William S. Vaux, Jr., and the Canadian Topographical Survey (1902), the average maximum rate of flow for several years is made to be about 6 inches per day.*

The Asulkan Glacier for 10 days in 1906 had an average daily motion of 6.7 inches.†

We unanimously decided that the Geikie Glacier was the finest we had seen in the Selkirks. Longer there are and greater, but for purity, variety of ice formations, and general interest the Geikie is unsurpassed. The stream descends for two miles below the Illecillewaet névé, reaching the extremely low altitude of 4,200 feet.

Not long after our day on the Geikie Glacier we struck camp and packed the outfit over Donkin Pass (8,600 feet), the lowest notch in the Dawson Range to the south. Crossing the boiling torrent from the Bishops Glacier, 2,000 feet below the pass, we found a beautiful camping spot on the westerly flanks of the Bishops Range, and set up our tent for a week's stay.

BISHOPS GLACIER AND DEVILLE NÉVÉ

From here we made an interesting trip over the glacier last mentioned to the divide and then down the icy slopes beyond to the Deville névé. This excellent glacial pass forms one of the few well-defined ways across the long rampart of the Selkirks, though it is hardly practicable for any but mountaineers. A survey party, while traversing it, in 1902, very nearly lost one of its members through the breaking of a snow bridge. Mr A. O. Wheeler writes of the incident as follows:

"We were descending the Mitre Glacier (now known as the Bishops Glacier) some distance from the sides, and were threading our way among the crevasses, when a shout behind caused the leaders to turn quickly around. No one was to be seen. My assistant had apparently vanished from the face of the earth. A second shout drew attention to the brim of a hat and an arm appearing above the edge of a crevasse. He had broken through the snow, fortunately catching his ice-axe on the opposite edges of the ice. The pit apparently led to the center of gravity, for we could perceive no bottom. It was a lucky escape."*

The beautiful Deville snow-field lies two miles south of the Illecillewaet névé, severed from it by an ice-walled gap called Glacier Circle. The two bear a striking resemblance to each other. They are of about the same area, both lie north and south at the same elevation, and both are buttressed on the east by a line of small rock peaks which rise with great regularity above the valley of the Beaver River. The Deville névé, however, is nourished by three large feeders, in this respect differing from the Illecillewaet.

BLACK GLACIER AND PURITY RANGE

A second expedition from our Bishops camp was made over the ridge of that name to the south. In the valley beyond a most interesting glacier is to be found flowing parallel to the Bishops Glacier in the same direction. But instead of being a single stream, this glacier is the product of four magnificent confluents, and, instead of having a uniformly white surface, a series of high moraines is freighted along, one from each member. For this reason it has been named the Black Glacier, though rather inappropriately, as a glance at the photographs will show (pp. 472, 478, and 479).

The panorama of this glacial basin as viewed from the Bishops Range is one of the most imposing to be found in the Selkirks. It is as if a bit of arctic landscape had been carried south and dropped down upon a rock-ribbed range far above tree-line.

The "Purity Range" seems a fitting name for the chain. Its dominating peak from this viewpoint is the glacier-draped

* See "Selkirk Range," by A. O. Wheeler, p. 360.

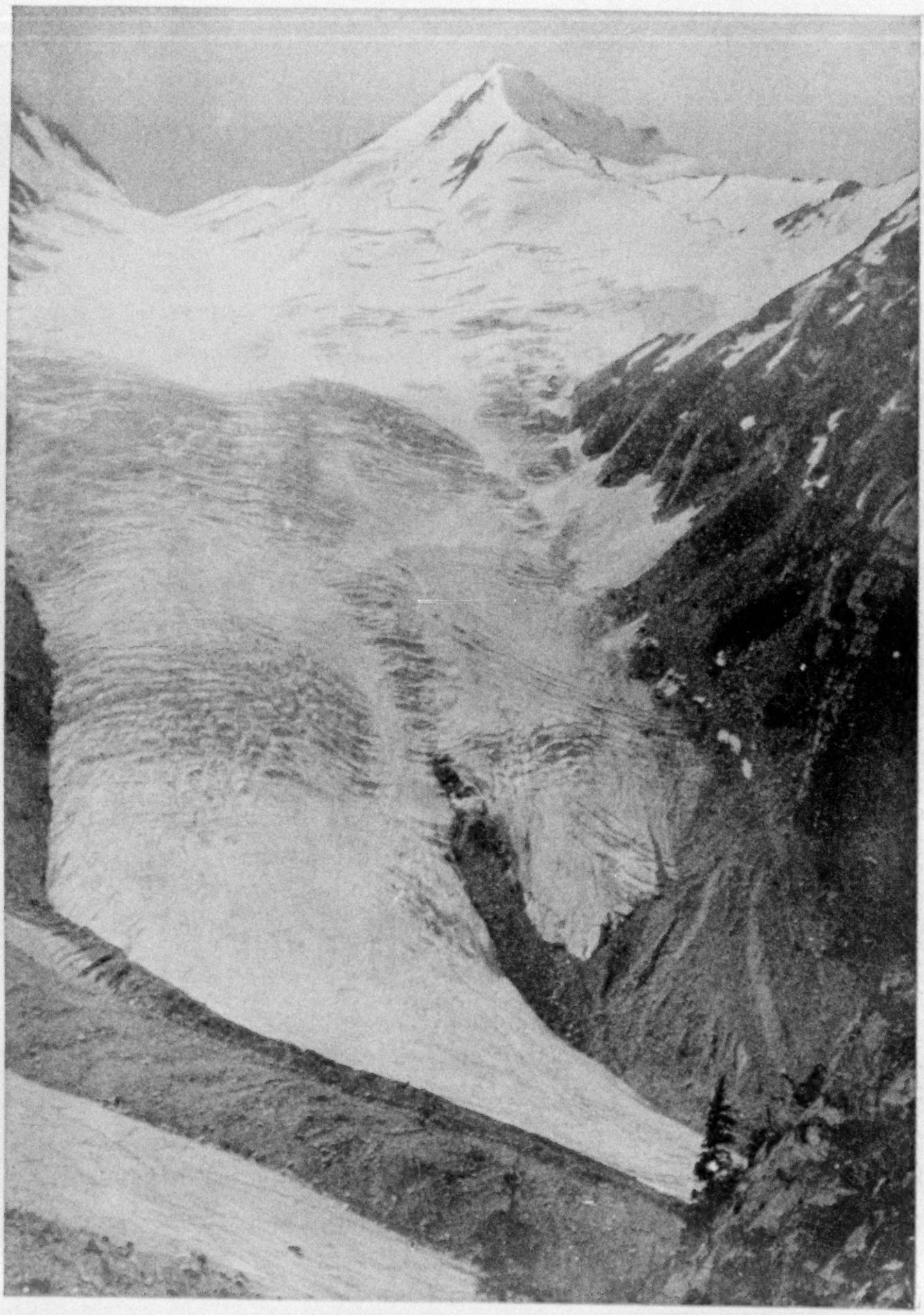
† Canadian Alpine Journal, Vol. 1, p. 147.

* Appalachia, vol. x, p. 133.

LOWER ICEFALL OF GEIKIE GLACIER

"Glittering towers of ice the size of a city building, grotesquely fashioned and tilted at impossible angles, had been reared aloft by the mighty force" (see page 461)

CURIOUS SNOW BRIDGES AND CREVASSE FORMATIONS ON UPPER PLATFORM OF GEIKIE GLACIER



PASS ACROSS PURITY RANGE WITH NAMELESS PEAK: BLACK GLACIER AT BOTTOM
The pass is to the left of the central peak (see pages 473 and 484)

massif of Mount Kilpatrick (10,624 feet), first ascended in 1909 by E. W. D. Holway, F. K. Butters, and H. Palmer. To the left, barely visible over the col at the valley's head, rises Mount Wheeler (11,023 feet), second only to Mount Dawson among the monarchs of the southern Selkirks.

Next to the west come four nameless peaks, and then the range terminates in the majestic mass of Mount Purity, perhaps the most striking peak of all. Seen from the upper slopes of the Bishops Range, this silvery spire, with its graceful aretes, symmetrical buttresses, and unique snow curtain lighted by the afternoon sun and outlined against a sky of deepest blue, forms a picture never to be forgotten.

BATTLE RANGE AND BATTLE GLACIER

Beyond the Purity Range to the south the country is practically a *terra incognita*. A strip averaging about four miles wide along the range is shown on the government map, but the data for this was obtained from distant photographs taken on the summits of Mounts Wheeler and Purity, and as far as we could learn no one had actually crossed the range to explore the district in detail. Below this strip the map was blank except for the words "Battle Range" in heavy type.

Since our first view of this region from the Purity Range it has interested us, and we had desired to accept the covert, though none the less alluring, challenge of the map, but previously to July, 1909, conditions had prevented our doing so. That month, however, found our party of three encamped on the flanks of the Bishops Range, all preparations completed for a visit to the virgin valley of the Battle glaciers.

The chief difficulty in our undertaking was to find a way down the southerly slopes of the Purity Range, for from Mount Kilpatrick these appeared to form a continuous wall of practically sheer cliffs along that side. The northerly slopes, on the contrary, looked accessible everywhere, so we selected the deepest notch in the skyline for our first trial. This cut the range near the middle and could be reached with facility from our camp. It took a morning's hard work to solve the maze of crevasses in the intervening feeder of the Black Glacier, but toward 2:30 p. m. we pushed into the col.

One hasty glance over showed that we had probably found a pass, for a steep finger of snow reached up from the further glacier right to our feet, bridging the rock wall in the neatest manner possible. Still, the entire route of descent was not visible, and a crest in the glacier below suggested the beginning of an ice-fall likely to form a serious if not insuperable obstacle, but we unanimously decided to risk it notwithstanding.

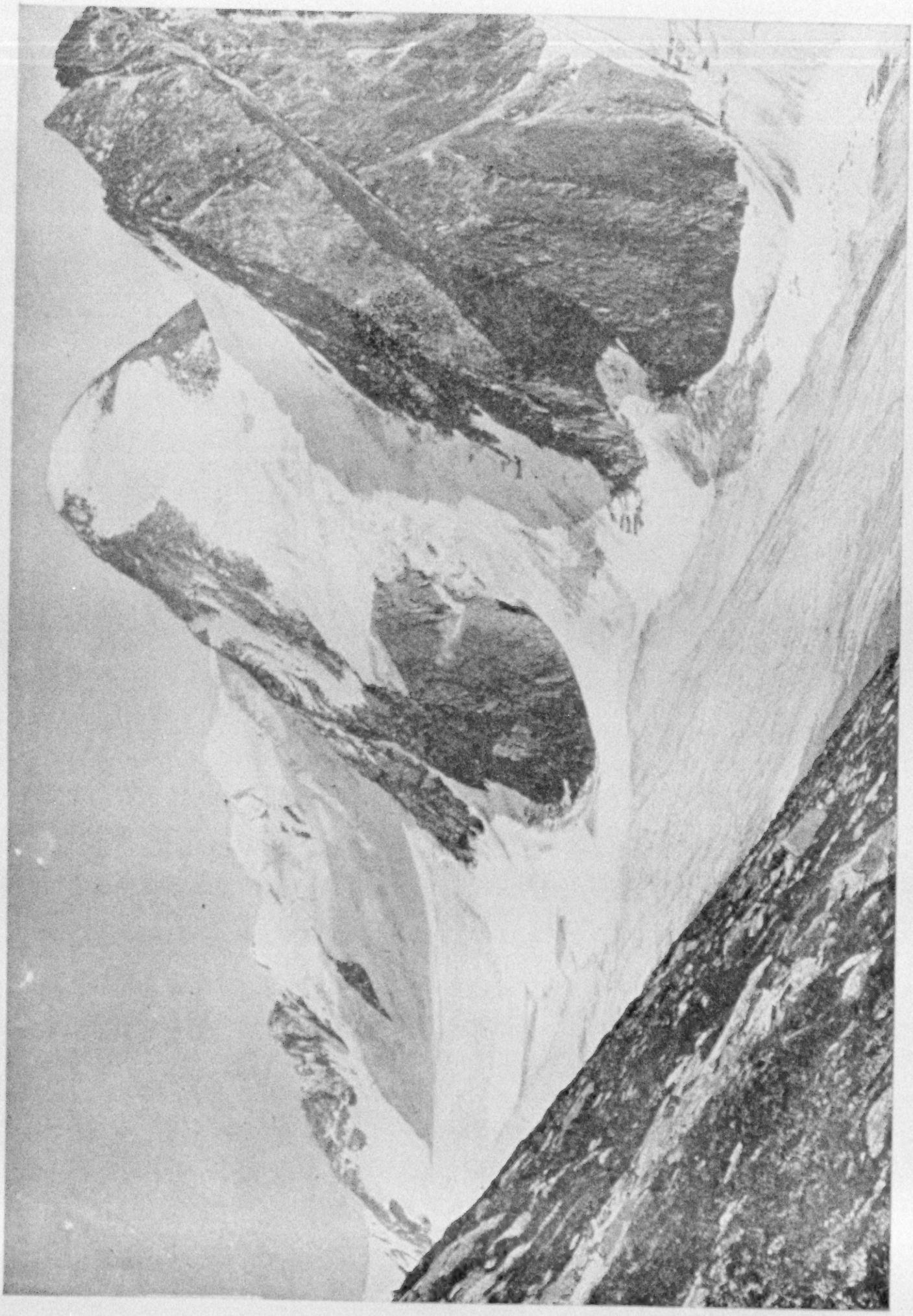
The view of the deep valley of Battle Creek was grand beyond description. On either hand rose rocky walls fringed with hanging glaciers, while below them in the valley wound another, the huge Battle Glacier, four miles from source to tip. Across the valley in the background soared the nameless black peaks of the Battle Range in formidable array. Sharp ridges of nearly equal height walled in high glacier basins, below which black, rocky slopes, shining with moisture, pitched steeply into the valley.

The most elevated point seemed to rise at the right, where a single rounded summit pierced the sky at an altitude not far from 11,000 feet. From its shoulders the snow fell away to the largest glacier in the group. All this formed an alluring, although somewhat forbidding, prospect.

We returned to camp and a day or two later again made the col, this time laboring under 40-pound packs. With scarcely a pause we plunged down the snow to the glacier and began a winding march between its crevasses. As we had feared, the crest seen from above concealed a huge ice-fall.

The glacier was gashed from side to side for fully 2,000 feet down. Surely our way was not there. Carefully following the edge, we turned to our left and made for the margin of the stream, where at length we were rewarded by

XUM



CYPRIAN PEAK (10,712 FEET) AND BISHOPS GLACIER (SEE PAGE 469)

MOUNT PURITY (10,457 FEET) FROM CYPRIAN PEAK

PANORAMA FROM MOUNT PURITY TOWARDS NORTH AND NORTHEAST

From left to right, Dawson and Bishops Range; then Mounts Wheeler and Kilpatrick at right. The precipitous southern slope of Purity Range is well shown by black cliffs in foreground to right

MOUNT KILPATRICK (10,624 FEET), FIRST ASCENDED IN 1909 BY MESSRS E. W. D. HOLWAY, F. K. BUTTERS, AND HOWARD PALMER (SEE PAGE 473)

the discovery of a moraine almost hidden under winter snow. Descending its curving crest, in half an hour we found ourselves at the foot of the ice-fall on the great level reaches of the upper Battle Glacier.

The sun had now set for us, though it was but 4 o'clock, burying the glacier as well as the valley below in deep shadow. Only Grand Mountain and the peaks in its chain were still bathed in bright sunlight. Haste was indeed imperative were we to camp before nightfall in the gloomy depression three miles below. Accordingly after only a moment's halt we shouldered our burdens and resumed our way. The next two hours passed in a monotonous grind, first through the slush of the glacier and then over the sharp stones of a great medial moraine which appeared to afford the quickest road to the valley. On our left the other branch of the glacier, emerging from a dark defile, joined ours, the two forming the mile-wide stream of Battle Glacier, shaped like a huge letter Y.

Dusk was upon us as we approached the crest of the high terminal moraine which had hitherto concealed the valley's depths where we hoped to camp. For the last four miles our route had lain through a forlorn waste of ice, snow, and jagged rocks. A few sparse patches of green grass did indeed clothe the slopes to the left here and there, but they only served to emphasize the barrenness by contrast. Not even a marmot's whistle had cheered us with its shrill note.

Unless our surroundings changed very considerably in the next hour, a night on the sharp stones of the moraine, with nothing to eat but crackers, chocolate, and dried fruit, was all we could look forward to. Accordingly it was not surprising that we hurried rather anxiously up the rocky slope toward the top.

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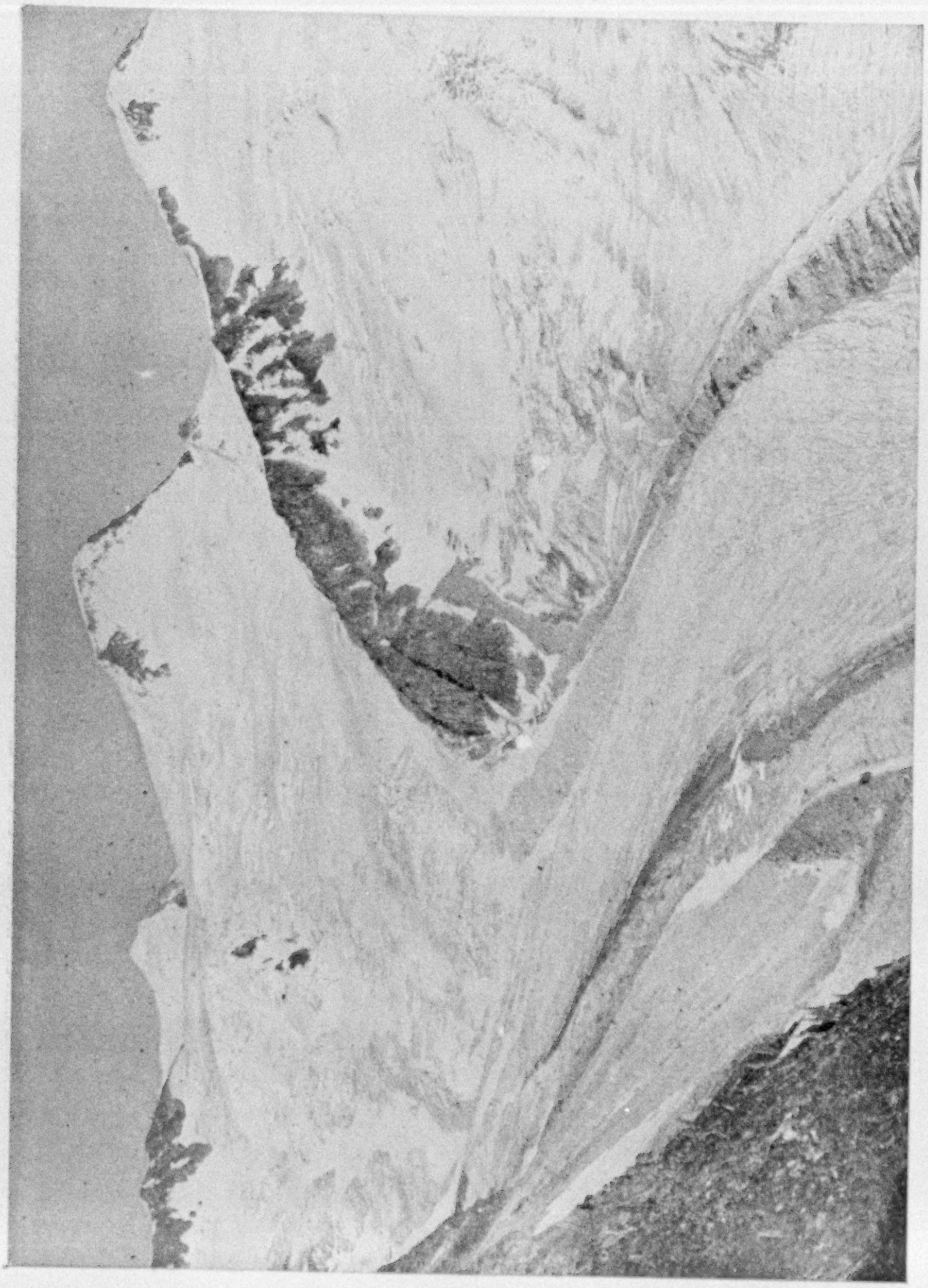
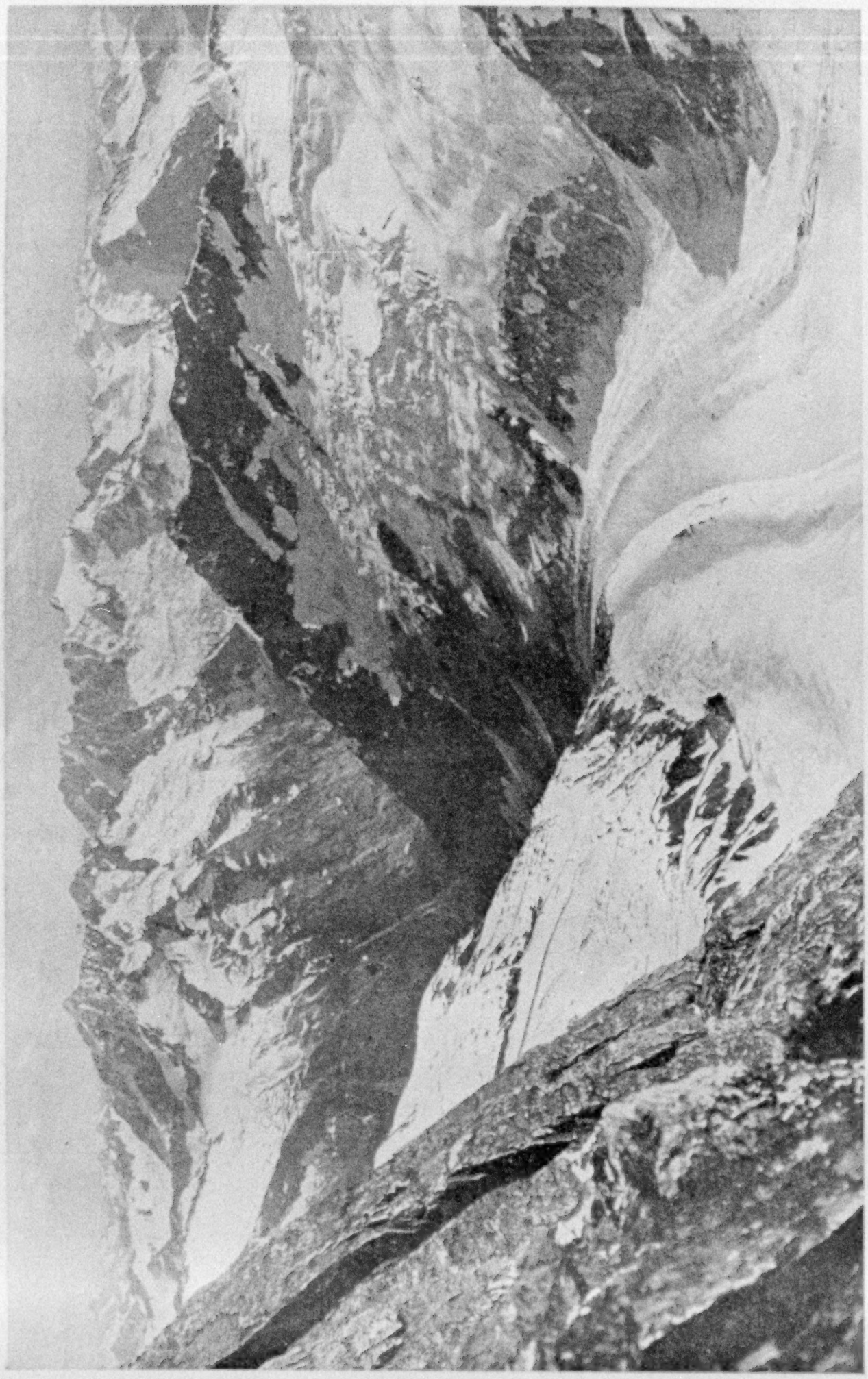


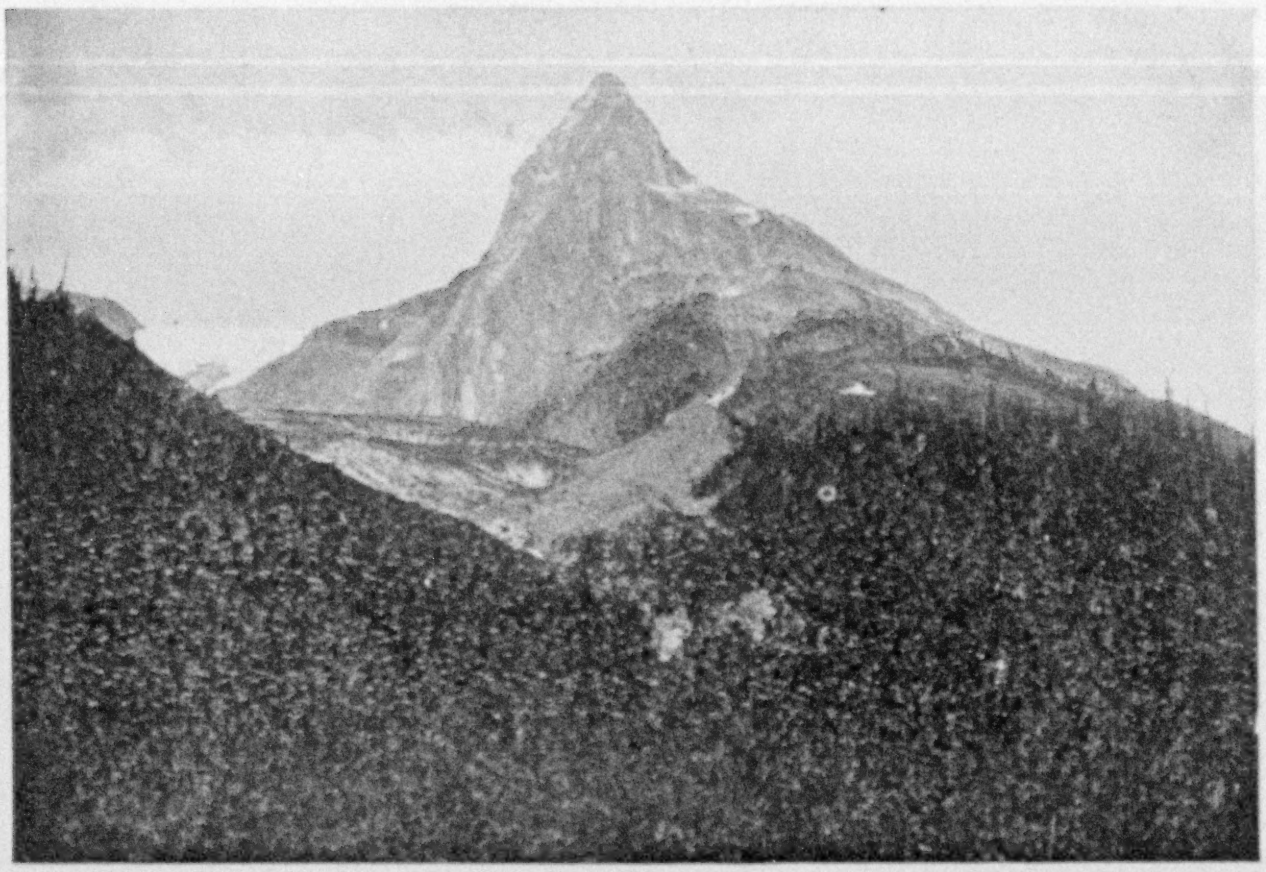
MOUNT KILPATRICK AND BLACK GLACIER (SEE PAGE 469)

THIS MASS OF BOULDERS AND ROCK IS FREIGHTED ALONG BY BLACK GLACIER (SEE PAGE 469)



BATTLE RANGE AND BATTLE GLACIER, SEEN FROM THE SUMMIT OF MOUNT KILPATRICK (SEE PAGE 473)

ANOTHER VIEW OF BATTLE RANGE AND VALLEY FROM MOUNT KILPATRICK



"A SINGLE MATTERHORN-LIKE SUMMIT TOWERED IN LONELY SPLENDOR"
(SEE PAGE 483)

The scene which greeted us was indeed one of wildest grandeur. Two hundred feet below us a raging torrent foamed out from beneath the glacier, racing into a narrow gorge with a thunderous roar. Lower down it emerged, and we could follow its course for perhaps a mile further winding between banks densely overgrown with alders. There the valley widened out and its gradients became gentler, but of forest there was hardly a patch. Alders and steep grassy slopes were the rule. Nearer, on either hand, its sides slanted abruptly back in rough rock-piles, breaking into cliffs higher up, where ice fringed the skyline and sharp summits stood out black against the evening sky.

It was a rather disheartening outlook for a hungry party with nothing but green wood in sight for miles. But we couldn't be worse off than where we were on the glacier, so we prepared to push further down the gorge on the chance that something better would appear.

Just then what was our surprise to see on a ridge of the moraine not 200 feet away a fine yearling grizzly bear. He had been traveling in our direction, but out of sight below the moraine, and his astonishment at finding himself suddenly face to face with three strange creatures was ludicrous to behold. He stopped short, looked us over for a full minute, then gave a deep "hoo wuff" and, turning around, disappeared. Regretting that our cameras were tightly strapped up in our packs, we continued our way down into the gorge.

We had progressed hardly a hundred feet when, above us on the mountain side, lo, another grizzly was sighted, this time a full-grown mother bear with a cub. She was nosing about in the alder bushes apparently unaware of our presence, and looking for all the world like a contentedly grazing cow.

With no arms but our ice-axes and no trees nearer than 5 miles, it did not seem wise to disturb the brute or to give her any reason for desiring to make our acquaintance, so we slid down the slippery forefoot of the glacier to the edge of the

torrent and pushed on down the valley, rather anxious, it must be admitted, as to whether there were any other specimens in the menagerie.

After a half hour's rough tumble over the boulders along the stream and through the alders fringing the canyon's lip, we reached the more open portion of the valley seen from above, and soon found a place in an old avalanche track where dry wood was abundant and the tent could be set up among the stones.

It was anything but an ideal camping spot. The only space for the tent consisted of a 6-foot stretch of water-worn rocks, the interstices between which were only partly filled by glacial silt, leaving their "summits" to indent the particularly weary portions of one's anatomy. Moreover, even this small area had to be cleared of the ever-present alders. But we were in a far from critical mood, and, in comparison with what might have been our lot, this was luxury.

A fire, soon kindled, dispelled the gloom and facilitated our lumbering and culinary operations. Ere long the tent was up (though rather precariously) and copious draughts of hot tea and pea soup were repairing the ravages of a hard day's work.

We had climbed about 4,000 feet under 40-pound packs, and descended the same distance, with 600 feet additional, covering a distance of 10 miles through untraversed country.

Next morning we were up early to view our surroundings. In the gloom of our arrival the heights had shown merely as dim shadows against the sky. Sounds of rushing waters in varying keys had reached us intermittently as the wind blew gustily down the valley, so we hoped for glimpses of waterfalls not far away. Not were we disappointed.

Almost directly behind our camp a beautiful cascade leaped out of the sky and came tumbling down from ledge to ledge in a foaming thread for a full 300 feet. Further to the right another gushed out, evidently the drainage from a glacier that was nearly hidden in a deep notch.

Fifteen hundred feet almost straight above this a single Matterhorn-like summit towered in lonely splendor, forming with its lower and more distant slopes the eastern wall of the valley. The corresponding wall at our backs rose even steeper to a belt of cliffs which extended for two miles along that side (west) and supported hanging glaciers as far as we could see. Its southerly termination was a sharp rock peak, around which the valley swung abruptly to the west.

Opposite this point stood the fine group of peaks shown on page 486. Altogether the scene presented the sharpest contrasts between heights and depths that we had seen anywhere previously.

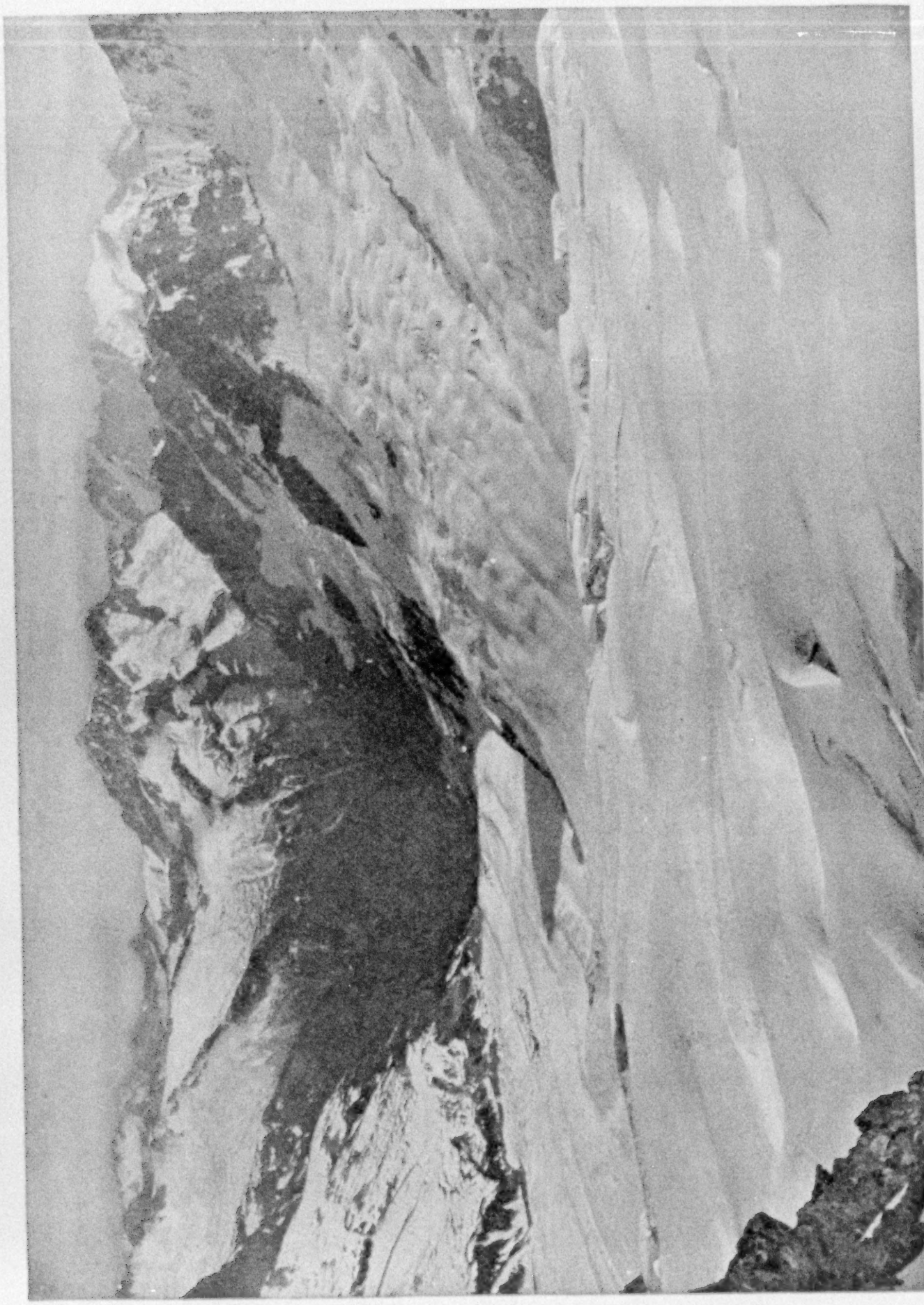
After a day spent in improving the camp we pushed down the valley in order if possible to view its course beyond the turn just mentioned. We followed a well-worn bear trail that wound through soft grassy alps, where evidently the animals often found comfortable quarters, to a point where the torrent entered a small canyon. Then we turned to the left and struck up a very steep alder-matted slope, attaining at length an altitude of 5,800 feet—2,400 feet above the valley. From here we obtained splendid views up and down its length, including one of a fine glacier basin below Mount Sugarloaf.

We had come a distance of about a mile and a half from camp in an airline, during which the valley dropped 500 feet. The creek in consequence had in places cut its channel through the loose morainic material to a depth of 75 feet below the general level. Lower down the gradient became gentler at an altitude of approximately 3,000 feet, allowing the stream to take a winding course through verdant meadows and groves of evergreens until it once again turned westward and was lost to sight.

Numerous tributaries from the high glaciers of the Battle Range bounded down over smooth rocky slants to join it, in two cases issuing from hanging valleys that cut back into the heart of the range. Our plan was to continue still further, but a heavy shower forced

XUM

NAMELESS PEAKS IN PURITY RANGE; THE PASS IS TO THE RIGHT OF THE CENTRAL RIB (SEE ALSO PAGE 472)



VIEW FROM THE SUMMIT OF THE PASS, SHOWN IN PRECEDING PICTURE, LOOKING DOWN INTO BATTLE CREEK VALLEY AND OVER BATTLE GLACIER

OUR CAMP IN BATTLE CREEK VALLEY; PART OF BATTLE RANGE IN DISTANCE

us to turn back, and we reached camp in a soaking condition.

The rain continued intermittently, but during the lulls we managed to cook supper and dry our clothes somewhat. Heavy showers battered the tent in the night, giving a severe test to its waterproofing. This might have been better, but we felt grateful that only a fine mist penetrated.

In the morning, under lowering skies, two of the party ascended the glacier occupying the notch east of camp and reached a knob near the arête joining Grand Mountain and Mount Sugarloaf. From this they obtained unobstructed views throughout the upper reaches of the valley. Everywhere steep rocky walls and jagged cliffs fringed with glaciers met the eye, making it apparent that the camp was not favorably situated for any ascents in its vicinity.

Rain again prevented our accomplishing anything the following day, and, as indications promised a storm of several days' duration at least, it seemed useless to remain longer, especially as our food supply was insufficient to allow us to move down the valley to a more favorable spot. Accordingly we started back on the fourth day over the same route, arriving at our camp on the Bishops Range at 9:30 p. m. in a howling snowstorm. A few days later we ended our outing by returning to Glacier.

Our experiences in the upper portions of the valley support those of W. S. Drewry and P. A. Carson,* both of the Dominion Land Survey, who on different occasions penetrated the valley from its mouth with a view to locating a survey station in the Battle Range. They found the going as bad as possible, and the former was "confronted by sheer precipices of rock and ice at every attempt" to make an ascent.

There is little doubt but that the Battle Range on this side is one of the most difficult in the Selkirks from the climber's point of view. The valley is a low one, which means a long pull to timber line and a bivouac there before snow and ice work commences. Conditions ought to be more favorable on the south side of the range, but nevertheless the sharp aiguilles and threatening towers will doubtless offer most interesting problems to an attempt from that direction.

* Annual Reports of Department of Interior, Canada, for 1892 and 1907.

WHERE WOMEN VOTE

By Baroness Alletta Korff

IN FINLAND for nearly three years women have been members of Parliament, and for the first time in history have "taken their places in a legislative assembly side by side with men, elected by universal manhood and womanhood suffrage."

The law granting the franchise to women came into effect on the first of October, 1906, so that now it is possible to estimate, in some degree at least, the value of the work that the women have done and the effect that woman suffrage has had upon the country at large.

Although at the time the suffrage was granted it seemed to people outside Finland radical and even revolutionary, in Finland itself the change was looked upon merely as an inevitable step in the natural process of the political and social evolution of the country, and was received without any signs of excitement whatever.

It is true that in some ways conditions in Finland have been peculiarly favorable to the advancement of woman's rights, but there have been also certain difficulties which do not exist in other countries, and which made the idea of woman suffrage seem an almost chimerical one

even as short a time ago as 1897, when the first official request was made.*

NOT ENOUGH EDUCATED MEN TO MEET THE REQUIREMENTS OF THE COUNTRY

From an educational point of view the women in Finland have been very fortunate, as there are many excellent schools for girls and a number of co-educational schools throughout the country which prepare students for the University examinations. Girls have been admitted to the University since 1878, and they not only attend lectures but take part in all branches of university life: they participate in all the celebrations and festivities, and are members of the various clubs and student organizations, in which they are on a footing of perfect equality with the men and are frequently elected to various official positions. After they graduate from one of the several high schools or from the University there are many branches of work open to them.

They may become teachers even in the state schools for boys, cashiers or bookkeepers in banks, clerks in the state archives, and in many branches of the civic administration. There are really not enough educated men to meet the requirements of the country, and consequently the cooperation of the women is a matter of vital importance. It not infrequently happens that even married women in comparatively good circumstances seek employment outside their homes.

Having thus such an excellent foundation to build upon, it is small wonder that the woman's movement soon found many active supporters. In 1863 the Diet had accorded the municipal vote to women taxpayers living in the country, and in 1872 to women living in the towns, all of whom were also given the right to be elected members of certain local self-governing bodies. In 1900 the women social democrats included the suffrage in their program, but the special activity for the suffrage began only in the year 1904, although in 1897 a petition had been officially presented to the Diet at the request of the "Finnish Woman's Association."

The reason why so little was done in direct furtherance of the cause of woman suffrage between the years 1897 and 1904 is that just at that time Finland was passing through a severe political crisis. The struggle which the country was trying to wage against what seemed to be hopeless odds roused all the women of the country to action and made them realize the immense influence that political questions had upon the welfare of their country and upon their own individual lives. Thus they learned by practical experience the value of, and the necessity for, organized cooperation.

When all the women of the country had once been thus united by a strong bond of common interest, it was only natural that when the political crisis had passed the women should work together in an attempt to gain a recognized position in the civil and political life of the country.

By the autumn of 1904 the political situation had changed materially and public gatherings were once more allowed. The first large meeting for the discussion of the question of woman suffrage was convoked by one of the women's societies, and was attended by over one thousand women from different classes of society and from different parts of the country. The petition which the women presented to the Diet at this time was not dealt with, however, for the situation of the country was still precarious.* Women nevertheless continued to play an active rôle.

WOMEN CHOSEN TO SERVE AS MEMBERS OF A STRIKE COMMITTEE

After the outbreak of the October revolution in Russia (1905), a sympathetic strike was declared in Finland, and several of the members of the central

* Unofficial requests had been made previously by both the women's societies.

* In this petition equal suffrage for men and women was demanded, and for the first time a demand was made that women be granted the right to sit in Parliament.

committee elected by a mass-meeting to manage the details of the strike were women.

The first action taken by the committee was to close all the liquor shops, saloons, and bar-rooms, and to organize a volunteer police force to keep order. After the second day the markets were reopened and the strikers were not allowed to cut off the water supply. In short, the strike was managed in a most orderly and systematic way, and no outrages of any sort were committed.

During the course of the strike numerous deputations were sent with petitions to the Governor General, and in each deputation there were women members. Thus, even in moments of grave political danger and at times when the utmost moderation and foresight were needed, the Finns were not afraid to trust their women.

The strike was ended by an imperial manifesto issued on November 4, 1905, which reinstated Finland in its earlier rights, and in the manifesto universal suffrage was spoken of as a reform that might soon be realized. This gave a great impetus to the work among the women. They were determined that when the question of the suffrage came up for settlement, universal suffrage should be granted to them as well as to the men. Both of the women's associations arranged numberless lectures and meetings. More than 300 women's meetings were held in different parts of the country. At one large meeting, called by the "union" on December 2, 1905, there were representatives from 122 different places, many communes sending two, three, and four representatives in order that all social groups and all shades of opinion might be represented.*

WHEN WOMEN ASKED FOR SUFFRAGE IT WAS GRANTED AS A MATTER OF COURSE

This was only one of a number of similar meetings. Many of the young women students in the University traveled about the country lecturing on woman suffrage, and there were also numerous meetings arranged and led by peasant women.

Curiously enough there was almost no opposition to the measure, and when it came before the Representation Reform Committee only two members voted against it, and in the Senate also there were only two counter votes. Then the question was put before the Diet, and was included in the imperial proposal submitted to the Czar and signed by him on the 29th of May, 1906.

The Constitution Committee within the Diet recommended women's political suffrage and eligibility for the following reasons: "At present women in Finland get exactly the same education as men, even in the same schools, since co-education has been adopted in wide circles. Women in our days are engaged side by side with men in many different lines of work, and the experience from these ordinary fields of labor, as well as from women's participation in social work and in philanthropy, is such that there is no reason to fear that women should not use their suffrage as well as men. Finally, women themselves have shown a strong desire to get it."*

Thus at the time that the suffrage was extended to women it seemed so natural and inevitable that every one received the news quite calmly, and even at the time of the elections there were no evidences of popular excitement, though by the change from limited to universal suffrage the electorate was suddenly increased from 10,000 to 1,500,000. The extreme orderliness, even on the two election days, was a matter of great surprise to all the foreign correspondents, who seemed to regard it as quite an incomprehensible state of affairs.

The various women's clubs and women's associations played an important rôle at the time of the elections and immediately before. They used every effort to encourage women who could speak well to go about and address meet-

* "Nylid" for November, 1905.

* "Englishwoman's Review," 1907.

ings, and they made it possible for them to do so, and for poor women to go to the polls on election day, by providing competent and suitable women to take care of their homes. Women members were appointed on all the electoral boards, and when the tickets were being made up the women showed great moderation, asking only that one woman's name be inscribed as over against two men's names on each of the party tickets.

As soon as the law had been passed granting the suffrage to women, women's interests were included in the various party programs, and, as each of the already-organized parties was very anxious to gain as many votes as possible, it seemed neither advisable nor necessary for the women to form a new and separate party of their own. The whole object of their endeavor was not to bring a new party into politics, but to infuse a new element into the parties already existing.

MORE WOMEN VOTERS THAN MEN VOTERS

The very great interest that the women took in the elections may be gathered from the fact that in Helsingfors, the capital, at the time of the second elections (in 1908), there were 19,640 women voters and 15,516 men voters registered.* It is true that the majority of the women voted for men, as there were only 26 women elected in a house of 200, but one woman received a larger number of votes than was given to any of the men candidates of her party.

In 1906, of the 11 Agrarians elected, 1 was a woman; of the 25 Swedes, 1; of the 25 young Finns, 2; of the 59 Old Finns, 6, and of the 80 Social Democrats, 9 were women, so that the proportion of women to men was approximately the same in all the parties except the Swedish.

Although the women deputies did not constitute quite one-tenth of the whole Diet (19 were elected in 1906), they proposed no less than 26 bills and resolutions, a statement of which will perhaps give the best idea of the special subjects in which the women were interested.

THE LAWS WHICH THE WOMEN ADVOCATE

There were three different bills for the abolition of the guardianship of the husband over his wife, and a new woman's property act; one for more rights of mothers over their children; four for raising the age of protection for girls; two for raising the age of legal marriage for women from 15 to 17 or 18; four in regard to the legal status of illegitimate children; two petitions for more extensive employment of women in state service; for a state subsidy in behalf of schools for domestic training; for an annual subsidy of 20,000 marks for temperance; for obliging municipalities to appoint a midwife in each parish; for an amendment of the paragraph of the Agrarian law which stipulates that sale of an estate annihilates all lease contracts; for encouragement and extension of co-education; for abolition of the law on domestic service; for the construction of a specified railway; for the establishment of a maternity insurance fund; for the appointment of women as sanitary inspectors; for amendment of the law on litigation in so far as women shall be granted the same rights as men in regard to legal assistance; for subventions to the distribution of free meals to school children; for pardoning the Finns that took part in the Sveaborg revolt; for the abolition of disciplinary punishments in prisons; for making it a penal offense to insult a woman on the public roads or in any other public place.*

Up to the time of the dissolution of the first Diet (March, 1908) only three of the women's bills had been debated and decided upon—the institution of midwives, domestic training, and the raising of the age of marriage from 15 to 17. Various other bills would probably have been passed by the Parliament if the sudden dissolution of the Diet had not put a stop to all parliamentary work.

* At the time of the first election in 1906 no separate count was kept of the number of men and women voters.

* Report for the "International Woman's Suffrage Alliance."

In the elections for the second Diet, which took place in July, the women voters outnumbered the men by more than 4,000 in Helsingfors, and by about 3,000 in the province of Nyland. This time 26 women members were elected. Of the 224 petitions presented to the second Diet, 29 were presented by women, and of these one was for the appointment of a woman sanitary inspector, one for the improvement in the position of women in state service, two for the extension of certain railways, and several for abolishing legal abuses under which women had been suffering. Nearly all the rest concerned various improvements in the care and education of children.

BALANCE OF POWER AMONG PARTIES NOT AFFECTED BY WOMEN

At the time of the second elections the women again joined the already existing political parties and made no attempt to establish a separate party of their own. Once more also the number of women representatives in each party proved to be in direct proportion to the number of men representatives of the respective party. In other words, the election of women members did not in any way affect the balance of power among the parties. This was also true of the third Diet, elected in May, 1909.

The personnel of the women members in the three Diets has been in the main the same. Among those elected to the third Diet were one factory inspector, one principal of a teachers' seminary, two doctors of philosophy (one of them an official in the state bureau of statistics), one principal of a girls' school, one historical writer and lecturer on political questions, one clergyman's widow, one peasant's wife, one girls' school teacher, one public-school teacher, five seamstresses, one editor of a Social Democratic women's weekly (a former servant girl), one hooper's wife, one crofter's daughter, two Social Democratic organizers, one without specified profession. Thus, as among the men, all classes of women are represented.

As the majority of the representatives are over 40 years of age, it is safe to assume that in almost all cases their children, if they have children, are of school age, or at least old enough not to suffer from their mother's temporary absence from home; and, moreover, in all but four or five cases, the women members of Parliament were previously engaged in wage-earning occupations which were more confining and less well paid than their present positions. In other words, the families of the great majority of women members of Parliament have gained socially and economically by their election to Parliament. It is perhaps interesting to note that there are three cases of married couples representing a constituency.

As regards the work of women members of the Diet, it is precisely the same as that of the men members, there being women representatives in all of the various committees. One woman, for example, is a member of four different committees—the committee which deals with questions of constitutional law, that which prepares bills concerning social and labor questions, that which presents the final parliamentary reports to the state, and the Grand Committee.

THE ABILITY TO VOTE HAS IMPROVED THE CONDITION OF WOMEN

Before the suffrage was granted to women the vast majority of requests made by them for the investigation of the conditions of life among women workers—for example, women factory-workers—were treated with polite indifference; now that women have the vote, all of their official requests receive serious consideration. Two women factory inspectors have been appointed, and a special appropriation has been made for the work of an investigating committee.

No one who followed the heated debates aroused by the bills concerning the "Married Woman's Property Act," the "Extension of the Mothers' Rights over their Children," and the "Abolition of the Husband's Guardianship over his Wife," can doubt the practical advantage that women have gained by having

women representatives in Parliament. An article which appeared in the *Jus Suffragii* while the bills were pending says: "The women members of the Law Committee, to which the bills were referred, have had to stand a hard fight. The men members in the committee, of all parties, whether bourgeois or Social Democrat, held that only the 'women's-rights women' urged the revision of the marriage laws, and the rest of womankind was content with the *status quo*. When this became known, protests came from all sides. Women of all sorts and conditions sent signed petitions to some of the women members of Parliament urging the revision of the marriage laws, and most of the women's associations took up the question and passed resolutions giving moral support to the women members, and urging the points in the bills upon the marriage question."

Moreover, the possession of the franchise has been of practical use to women, not only by giving them the possibility of improving the conditions of their work and extending their legal rights, but also by helping them directly to better their economic position. Not long ago a test case was brought up by a woman teacher in one of the high schools, who claimed that as she was doing the same work as the men teachers and had passed the same examinations, she should be given the same salary. After a short discussion her request was granted, whereas similar requests made before women had the franchise had not been granted.

SCHOOLS TO TEACH GIRLS TO BECOME EFFICIENT WIVES AND MOTHERS

But as might be expected, the chief interest of the women has been to improve the condition of children. Over 50 per cent of the bills introduced into the three successive Diets have concerned the welfare of children. Many have been for rendering medical aid to poor women throughout the country districts, and for instructing them in the proper methods of caring for infants; many have treated of the improvement and extension of the public-school system and the care of school children; still others have dealt with special classes of children, orphans, waifs, and juvenile delinquents.

Now that the system of home instruction and private tutoring has passed perhaps forever—practically all children of nine or ten are sent to schools, and a large number of them to public schools—it seems only natural that women should take a tolerably intelligent interest in the management and direction of those schools and the state or municipal laws which govern them. When, too, in these days of democracy, the great majority of boys and a large number of girls also must look forward to earning their own living, it is only to be expected that women should feel the vital importance of investigating and, if possible, ameliorating the conditions of industrial life.

One of the noteworthy reforms undertaken by the women has been the establishment of schools of domestic training throughout the country—schools intended to teach young girls to become efficient and capable wives and mothers. These schools are of great importance, especially in the country districts and among the poorer class of people. They are becoming most valuable factors in the cultural development of the country, and are doing more than could perhaps be done in any other way to raise the general standards of living.

Thus the women have succeeded in materially bettering their own position; but they have done much more, for they have also carried through reforms of wide-reaching importance to the moral and social life of the whole community. A striking proof of this may be shown by the fact that in the church synod held in 1908 it was decided to grant women the elective suffrage for sundry church offices.

This motion was brought before one of the most conservative bodies in the country by a member of the synod who had previously been opposed to granting the political suffrage to women, and who introduced the motion of his own accord, saying that since the women had proved

themselves such efficient social and political workers, he felt that it would be an advantage to the church if they should be made eligible to many church offices.

The experience of three years of woman suffrage in Finland has proved, I think, beyond doubt that the emancipation of women is not a thing to be feared or dreaded, but merely a natural step in the evolution of modern society.

When the suffrage was extended to the women they responded with interest and enthusiasm, and have shown themselves capable of serving on all the various legislative committees. They have not disturbed the political balance of power, but have maintained it precisely as before, uniting as women only for the furtherance of social and legal reforms of importance to women, but also of very vital importance to the welfare and prosperity of the community at large.

Families have not been broken up by the woman's vote; rather have they tended to become more united by a strong bond of common interest. Instead of lessening the interest that women take in the education and the welfare of their children, the suffrage has greatly intensified that interest by making it possible for them to regulate and, in some degree at least, to improve the schools to which their children are sent and the different branches of work which they later undertake.

Experience has shown, too, that when the doors are opened, not all women rush madly into political life, but only those who are specially qualified for it; that for the vast majority of women the duties of the franchise consist in little more than casting their ballots, and that even the women who participate actively in political life devote no more time to it than they devoted previously to their extra domestic occupations or professions—that is, that even the small number of women who actually sit in Parliament need not neglect their homes unduly. But last and most important of all, it has shown that the cause that women have most at heart is the care and welfare of children.

NOTES ON FINLAND

DESPITE the obvious dissimilarity between Finland and the United States, the two countries have, nevertheless, many points in common, for Finland stands in much the same position in relation to Sweden as the United States does in relation to England, from the point of view of language, of social institutions, and the position of its women.

The Swedish language, brought over by the Swedes who early settled along the coast, became the language of culture in Finland, and the written language is still identical with the written language of Sweden, but in Sweden it is spoken as English is in England—with a rhythmic cadence and a rising inflection. In Finland Swedish is spoken as English is in America, less formally and with more variation in emphasis. In Finland, also, certain words in common use have changed their connotation, just as certain English words have in America.

But whereas in America the English language is the common language among all classes of the population, and serves as a bond of union which all foreigners coming to the country are anxious to share, in Finland now the Swedish language has become a great stumbling-block.

Formerly the Swedes were in almost absolute control of the social and political life of the country, and the language of the Finnish peasants of the interior had, in the early days, little influence on the general life of the country.

Within the last few years, however, Finland has passed through a marvelously rapid process of evolution. Many Finns of pure Finnish stock have become doctors and lawyers, Senators and college professors; the Finnish peasants have gained political equality and they are now demanding equal educational advantages, so that now the question of language has become a question of vital importance.

The current belief in America seems to be that the life of the country, politically, socially, and intellectually, is something quite distinct and individual, neither

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Swedish nor Russian, Latin, Teutonic, nor Anglo-Saxon, and that the language in common use is Finnish.

As a matter of fact the culture of the country and the political institutions were all derived from Sweden, and Swedish is the language spoken in nearly all of the coast towns and in the country districts bordering on the coast. Swedish has always been the language of the upper classes, and until recent years Finnish was rarely heard except in the interior of the country and among the peasants.

The nationalistic wave that has swept over England, bringing in its wake the Welsh revival and in Germany the less creditable anti-Polish movement, penetrated even to Finland, and many patriotic Finns are now desirous of abandoning the Swedish language and replacing it by Finnish. At present the movement is a very strong one, but how long it will last and whether or not it will be ultimately successful are matters open to conjecture.

The Finnish language at present possesses no literature with the exception of the *Kalevala*, the Finnish national epic, and certain novels and stories that have been written within the present generation. The literary language is in process of formation, and every present-day writer finds it necessary to coin numberless words to designate objects unknown to the simple peasants and shades of meaning which correspond to the subtler feelings of a more complicated and cultured civilization.

We are not here concerned with the question as to whether or not it is the part of wisdom to foster a language which has 15 cases, bears little relation to any other language except that spoken by the Estish peasants of the Baltic coast, and is a far more difficult language to learn even than Russian. The supporters of the movement have, at any rate, the excellent argument in their favor that it is the native tongue of about 85 per cent of the population, and that any other language must be always, to the great mass of the people, a foreign tongue, and that a people can only attain to the highest forms of poetic and literary expression in their own native language.

BARONESS ALLETTA KORFF.

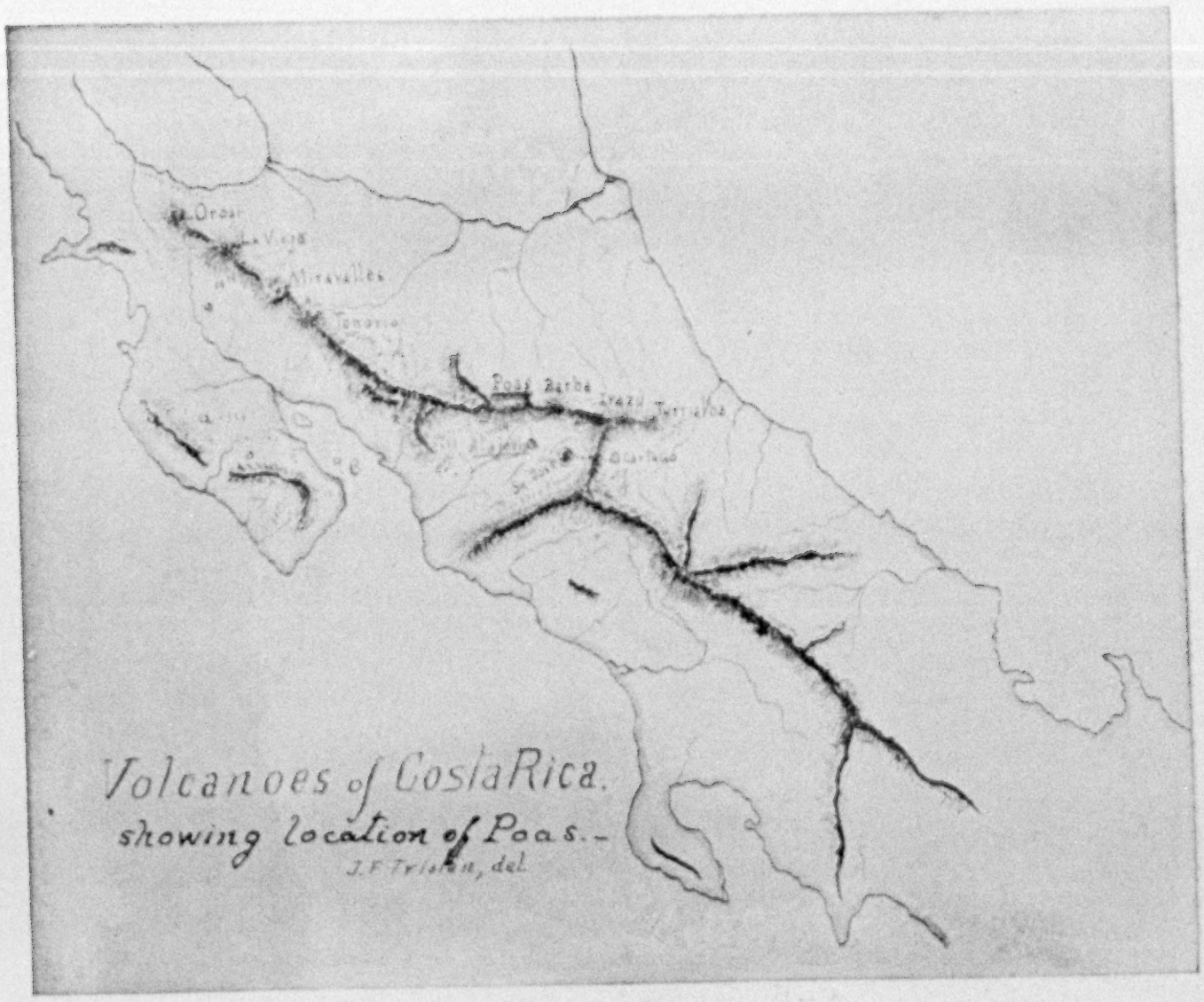
COSTA RICA—VULCAN'S SMITHY

By H. Pittier, of the U. S. Department of Agriculture

For 15 Years Director of the Physical, Geographical Institute of San José, Costa Rica

THE earth's crust underlying Costa Rica and the whole of Central America is one of mother earth's great laboratories. The chemical work that is going on uninterruptedly deep below her glorious mountains is made evident to the inhabitants of the country by the numerous volcanoes and warm springs, as well as by the almost ceaseless upheaving of the soil, mostly in tremors imperceptible to the senses, but also occasionally in powerful and destructive commotions.

The mountains of Costa Rica are divided into two main systems. The southeastern system, which has one peak of 12,467 feet elevation, is at present without volcanoes, although its skeleton is formed mainly by old eruptive rocks. The peaks of the northwestern system, of less development and elevation, are mostly active or semi-active craters, the base of which is geologically of very recent origin. This chain begins with the conical peak of Turrialba, which rises in an uninterrupted slope from the plains



of Santa Clara, about 1,000 feet above sea-level, to the towering height of 10,965 feet. Its beautiful crater, forming a narrow, elongated basin, is constantly active, a strong current of sulphuric and aqueous vapors, mixed with sand, escaping noisily from a broad vent at its westernmost extremity. The only known violent eruption of this volcano, however, took place in 1869, when it poured forth huge quantities of stones and fine sand, the latter of which were carried by the trade-winds westward to Punta Arenas and farther away over the Pacific Ocean.

Within close proximity of Turrialba is Irazú, about 360 feet higher, and far better known on account of the facility with which it is reached on horseback from Cartago. This volcano shows three large extinct craters, and, far down on its northern slope, numerous solfataras and hot-water springs. It enjoys the undeserved reputation of being the one point from which both the Atlantic and Pacific oceans are visible at the same time—a peculiarity that in reality is shared by Turrialba and several other points of vantage along the ridge of the southeastern system. Its historical eruptions took place in 1723, 1726, 1821, 1822, 1844, and 1847, singularly enough in each instance, except the first (which began in February), during the month of May. The eruption of 1847 was simultaneous with heavy earthquakes, which were felt from Rivas in Nicaragua to the city of Panama.

POÁS, THE WORLD'S BIGGEST GEYSER

From Irazú the range continues westward until it reaches Poás, a picturesque mountain with a geyserian crater, photographed for the first time by the writer in 1888, and which seems to have shown

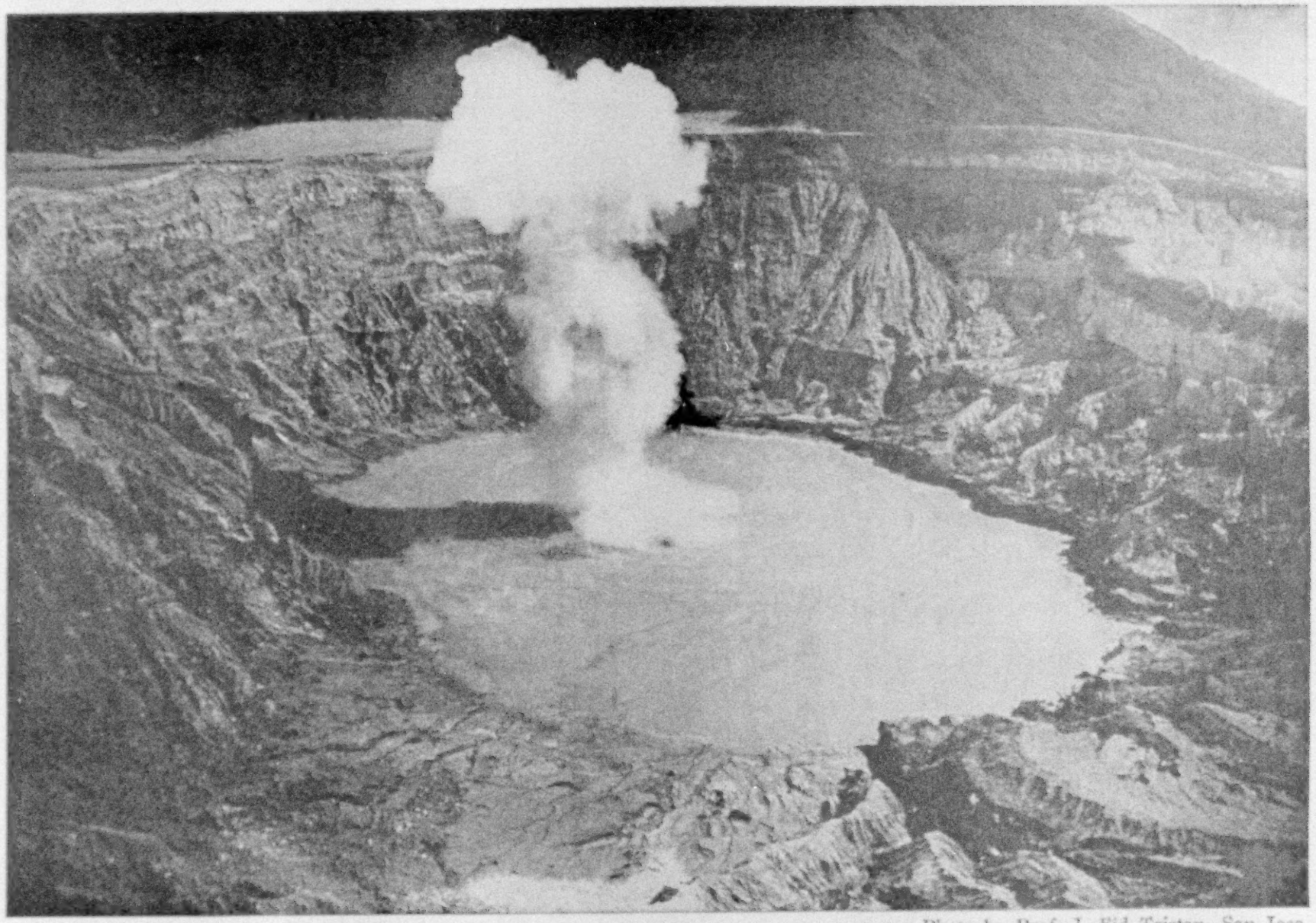
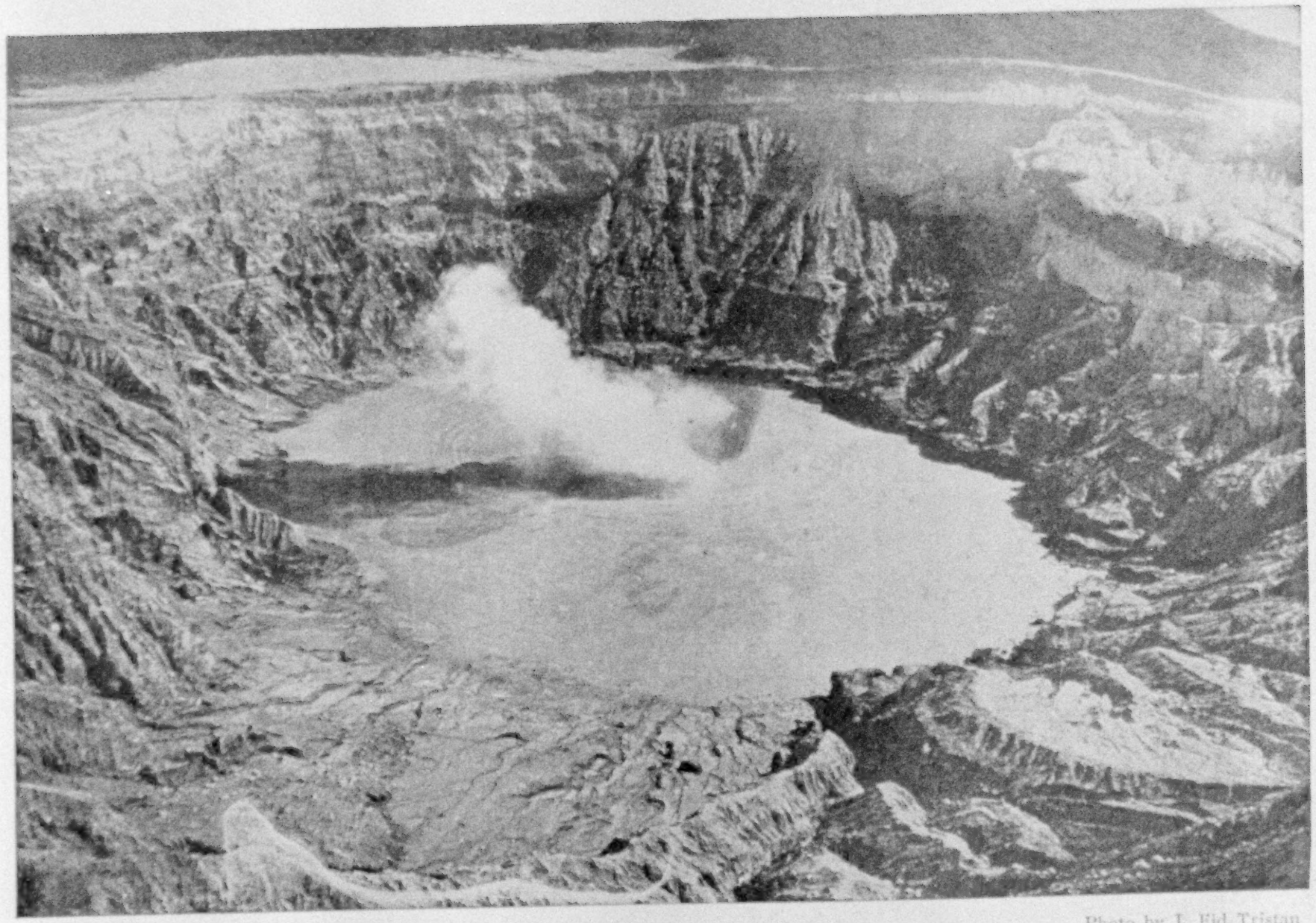


Photo by Prof. J. Fid Tristan, San Jose

THE WORLD'S LARGEST GEYSER: POÁS GEYSER, COSTA RICA

Geysers or hot-water volcanoes are sparsely distributed on the map of the world, and have been often studied and described. It will therefore be a matter of surprise to many readers to learn that the highest and by far the most formidable of them is not located in Iceland, nor in the Yellowstone National Park, nor in New Zealand, but in the little Republic of Costa Rica, on the northern boundary of Panama. The column of steam and water, shown in this picture, is 1,000 feet high.



A VIEW OF POÁS WHEN SIMMERING

Photo by J. Fid Tristan

The intervals between the eruptions are very irregular. Prof. J. Fid Tristan, who has made several visits to the geyser at different seasons of the year, writes that he rarely saw the geyser in the same condition as on a previous trip. Sometimes it appeared entirely quiet, without an eruption for many hours; at other times it was covered with clouds, the mist being so thick that one could hardly see farther than a few feet below the edge of the crater. At other periods the eruptions were very frequent, and in some of them the column of water and steam reached several thousand feet.

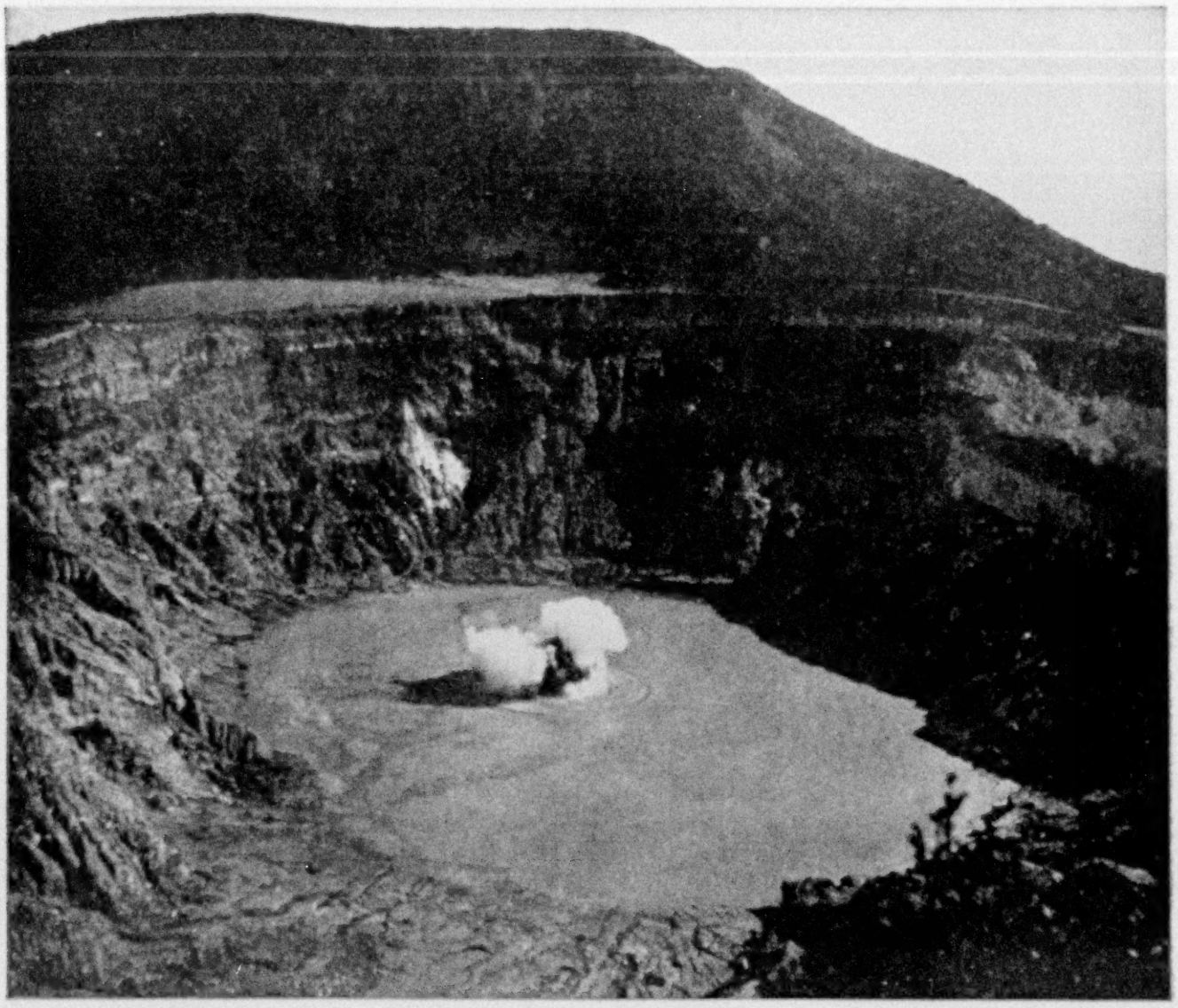


Photo by J. Fid Tristan

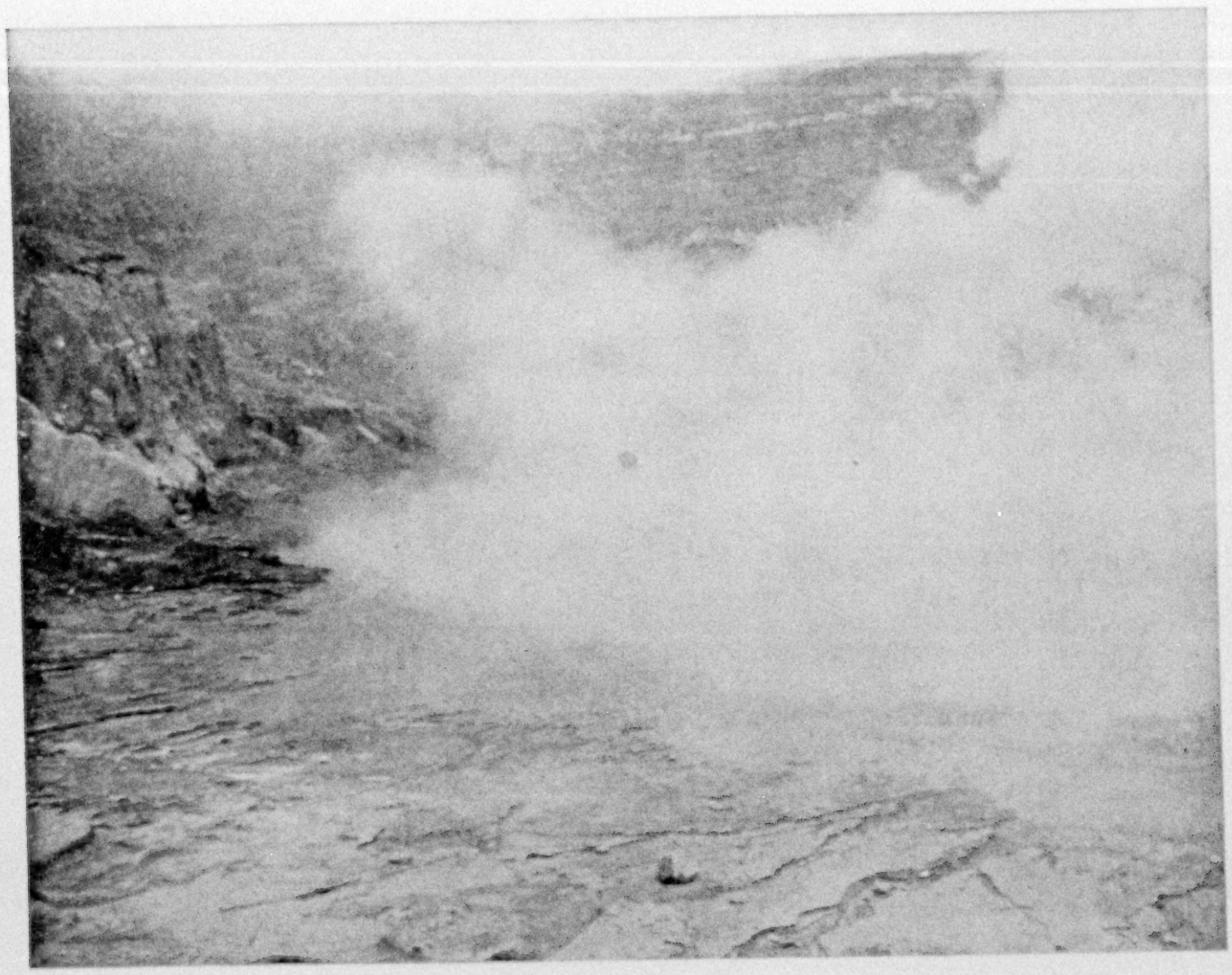
Poás crater is more than half a mile wide. Its walls are steep and precipitous and about 800 feet deep. The geyser ejects mainly water, but sometimes ashes and mud. In this picture rising mud can be seen distinctly in the center.

of late an unusual activity coincident with the long series of quakes that have just afflicted Costa Rica.

Poás has at least two craters. The higher one on the pyramidal top of the mountain is extinct and filled by a marvelous sheet of blue, cold water, framed in an exuberant border of semi-tropical vegetation; the other crater, 1,000 feet lower, showing at its bottom a lead-colored lagoon, is surrounded by almost vertical jagged walls of gray pumice and other eruptive materials. This is a geyserian basin, the eruptions of which occur at irregular intervals of from 12 to 20 minutes or more, and with variable intensity. At times the water, which tastes like strong vinegar, is hardly disturbed; at other times a heavy column accompanied by dense clouds of vapor surges to a variable height, creating a furious tempest on the usually placid lake.

In 1889 the writer witnessed the rise of a column of muddy water about 1,000 feet in height, while in January last it attained, according to official reports, no less than 13,000 feet. Like Irazú, Mount Poás is of very easy access, and of late it has become very popular on account of the variety of its natural beauties. Before the January eruption of the present year it was not known to have had any dangerous outburst in historical times.

The volcanic cordillera of Costa Rica



THE BOTTOM OF POÁS CRATER Photo by J. Fid Tristan

ends near the southwestern extremity of Lake Nicaragua with Mount Orosí, the conical form of which denotes its igneous origin. But between it and the Poás geyser there are a number of other craters, some still in semi-active condition and the others quite extinct. Among the latter, the most conspicuous are Tenorio and Miravalles, well known to the officers of coasting vessels trading between Panama and San Francisco, because they are the beacons which indicate the position of the Gulf of Nicoya and the port of Puntarenas. We must not forget to add that the altitude of the range decreases steadily from Irazú westward, the peak of Orosí having an altitude of only 5,154 feet.

ROCKED BY EARTHQUAKES

The maximum of volcanic activity takes place at the eastern end of the range, and it is also that section of the country, just at its southern foot, between Turrialba and Poás—the so-called central plateau—that is most exposed to disastrous earthquakes. It is at the same time the most densely populated part of the whole country.

This central plateau then is almost constantly rocked by underground convulsions of variable intensity. From 1866 to 1903, inclusive, the average yearly number of recorded shocks was 34, about half of which were generally felt in San José and its immediate vicinity. The maximum number of shocks, 103, was reached in 1900, but during that year there were no very heavy quakes. Contrary to the opinion current among the natives, that these earthquake phenomena are more frequent at the beginning and at the end of the rainy season—a view formerly sustained by the writer

Photo by J. Fid Tristan

CLIMBING OUT OF POÁS

himself—there is no seasonal periodicity, the seisms being distributed almost evenly throughout the twelve months.

The quakes very seldom come singly, but mostly in groups, with one or several culminating shocks at some point of the series. In the 1888-'89 series, of which the writer made a special investigation, the phenomena began October 11, 1888, with almost imperceptible trepidations, and continued to increase until December 30, at 4.12 a. m., when a destructive shock worked havoc in San José and in the neighboring towns, and then steadily diminished, finally ending on February 18. The total number of separate shocks registered by the instrument was 45.

Notwithstanding the fact that in the minds of the highly imaginative and excited natives the volcanoes were the original cause of the disturbance, these hardly showed any unusual activity, as was made clear by a careful exploration; but this failed to satisfy the public, and the responsibility was speedily shifted to a hitherto unheard of crater, the *Cacho Negro*, which gave the investigating commissioner more trouble and headaches than all the real volcanoes and earthquakes taken together.

THE ERUPTION OF POÁS, JANUARY, 1910

In the most recent happenings, the disturbances seem to have started with a colossal eruption of the Poás geyser on January 25 last. On that day, at about 5 p. m., an extraordinary smoke-like column was seen from San José rising to a prodigious height, which the scientific commission, appointed later to investigate the volcano, estimated at no less than 13,000 feet. After reaching its higher point, the column spread into a mushroom-shaped grayish cloud, which, carried by the anti-trade winds, soon covered like an immense screen the whole valley of San José.

An hour after the first indication of the unusual phenomenon, a rain of ashes or volcanic sand began to fall in the capital, situated at about 20 miles, as the crow flies, southwest of Poás. Traveling in the direction toward the latter, it was noticed that the sand increased in quantity as well as in the size of its grains.

In the near proximity of the crater the volcanic mud was strongly mixed with stones, many of which, measuring as much as 1.3 foot in diameter, had broken in their fall thick limbs and roots of trees and penetrated deep into the ground. The geyserian crater itself had resumed its usual placidity, its eruptive manifestations even seeming to have stopped altogether.

From his practical knowledge of the usual course of events, the writer surmises that from the date of the above-described eruption there were repeated earth tremors in the surrounding region,

and these increased in both intensity and frequency up to the date of the two successive catastrophes that befell the unfortunate little Republic. Information, however, is lacking, owing to the regrettable fact that the condition and assistance of the observatory in San José are no longer what they used to be.

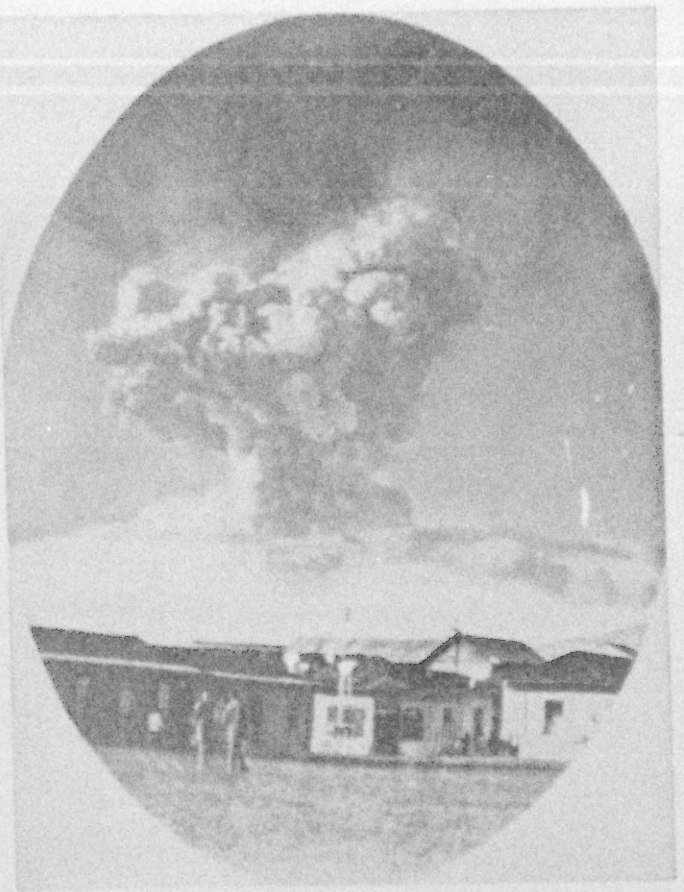
SHOCKS IN APRIL

On April 13, thirty-seven minutes after midnight, the population of the central plateau were suddenly awakened from their slumber to realize that everything around—the houses and their belongings, the churches, in the belfries of which the bells were madly ringing, the trees and the ground itself—was violently shaking. Without losing time even to put on the most elementary covering, every one ran to the open, and in a few minutes the streets and plazas were filled by terrified, clamoring crowds, some already discussing the probable origin of the quake, but most of them on their knees, loudly imploring the protection of the Saints.

Meanwhile the earth continued trembling, and up to 8.15 a. m. there were felt no less than 23 shocks, which, however, were of steadily decreasing intensity. Then everything was quiet again until 1.11 p. m., when there was another, apparently isolated shock, followed by two more at about 3 p. m., and again a single one a little after 10 o'clock. On April 14, 24 tremors of minor intensity were recorded, and on the 15th 12 more had been reported up to 2 p. m.; but only the first shock, at 12.37 a. m. of the 13th, and possibly the following shock at 1.07, were of a destructive character.

There was no loss of life, but in San José several public buildings were so badly wrecked as to become unfit for use, and walls of hundreds of private houses, many of them substantially built, were cracked or otherwise injured.

Cartago suffered damages of the same kind, and, moreover, the ground in its surroundings was rent and fissured at several places. The strongest shocks were felt along the foot of the Cordillera volcánica from Siquirres, at the eastern foot of Turrialba, to Lake Nicaragua, but they were most severe in the central plateau. In Port Limon the two first shocks only were felt, but were scarcely perceptible.



THE ERUPTION OF POÁS GEYSER, JANUARY 25, 1910 (SEE PAGE 500)

The photograph was taken in San José, about 25 miles distant, by M. R. Soriano, and sent to the NATIONAL GEOGRAPHIC MAGAZINE by Prof. J. Fid Tristan, of San José.

After a few days, no more seismical records were reported, though it is doubtful whether the earth tremors ceased completely. The excitement subsided, the throngs, camping in the parks under military tents and other improvised shelters, began to flock back to their usual abodes, and everybody's attention became fixed again on the coming political event, the inauguration of a new administration. This was to take place—as it did, although under the most distressing circumstances in the history of Costa Rica—on May 8.

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Photo by J. Fid Tristan

A HOLE MADE BY FALLING STONE ON THE EDGE OF THE CRATER OF POÁS
(SEE PAGE 500)

Some of these holes were 3 feet deep. Note the white ashes which has shrouded the vegetation

The shower of ashes from Poás, January 25, 1910, covered the trees and shrubs for many miles around with a beautiful white powder (see page 500)

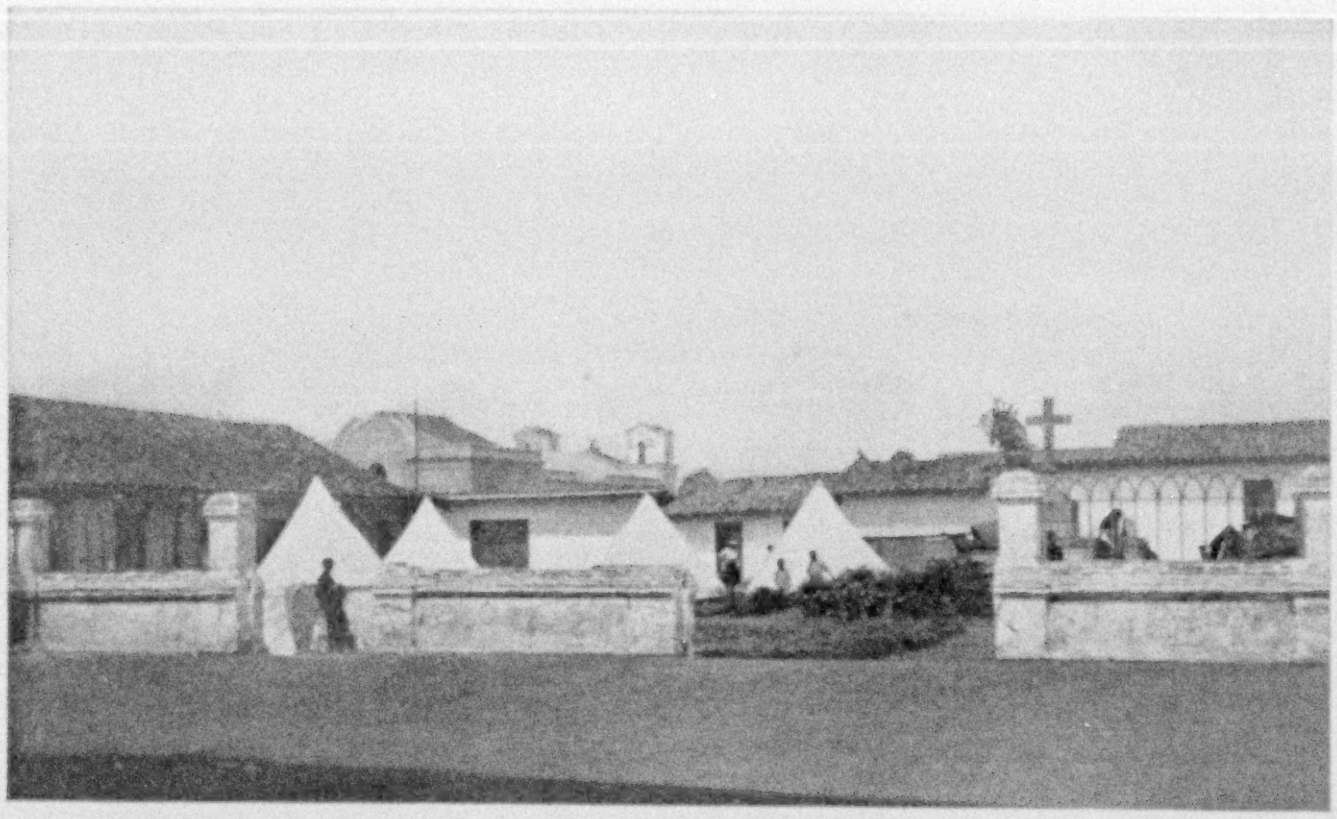


Photo from Rear Admiral F. Singer, U. S. N.

A succession of shocks during April so frightened the people of Cartago that they camped out in the parks and open places during the earlier weeks of the month. Gradually the shocks subsided and the people then returned to their houses to be overwhelmed by the terrible quake of May 4 (see page 501).

THE CATASTROPHE OF MAY 4

Meanwhile the underground forces were not inactive, even though the public ceased to pay due attention to the warnings of the seismological apparatus or these had stopped working. On Wednesday, May 4, twelve minutes after noon, a premonitory oscillation was felt at San José and Cartago; but if it again awakened the fears of the timorous ones, it was not enough to render them suspicious of the possibility of worse happenings.

At 6.50 p. m., when the early tropical darkness had sent most people home to prepare for their nightly rest, a sudden shock, coming apparently from beneath their feet, converted Cartago in an instant into an immense heap of rubbish, from which rose in the midst of deafening crashes and underground noises the death shrieks of hundreds of victims and the agonizing appeals of living ones imprisoned beneath the debris of their abodes.

A point on which most witnesses agree is the sharpness of the most destructive shock; it was followed indeed by a series of oscillations which lasted for several seconds, but the disaster was a thing of the first impulse and of imperceptible duration.

Of the people that were taken alive from the ruins, only a few had had time to follow their instinct or the inspiration of a rare presence of mind and to glide under a table or bedstead; among the dead a merchant was found with the pen still between his fingers, crushed flat upon the ledger in which he had been writing; a shoemaker lay with his arm stretched above his head, hammer in hand, as in the act of striking the sole.

No pen could picture the horror of the situation; the uninjured running about blindly through the debris, too dazed to know what to do; the electric-light plant out of commission, and every lantern in the place smashed, so that everything was wrapped in complete

ONE OF THE PRINCIPAL STREETS IN CARTAGO AFTER THE EARTHQUAKE OF MAY 4, 1910

darkness; all means of communication with the neighboring towns cut off.

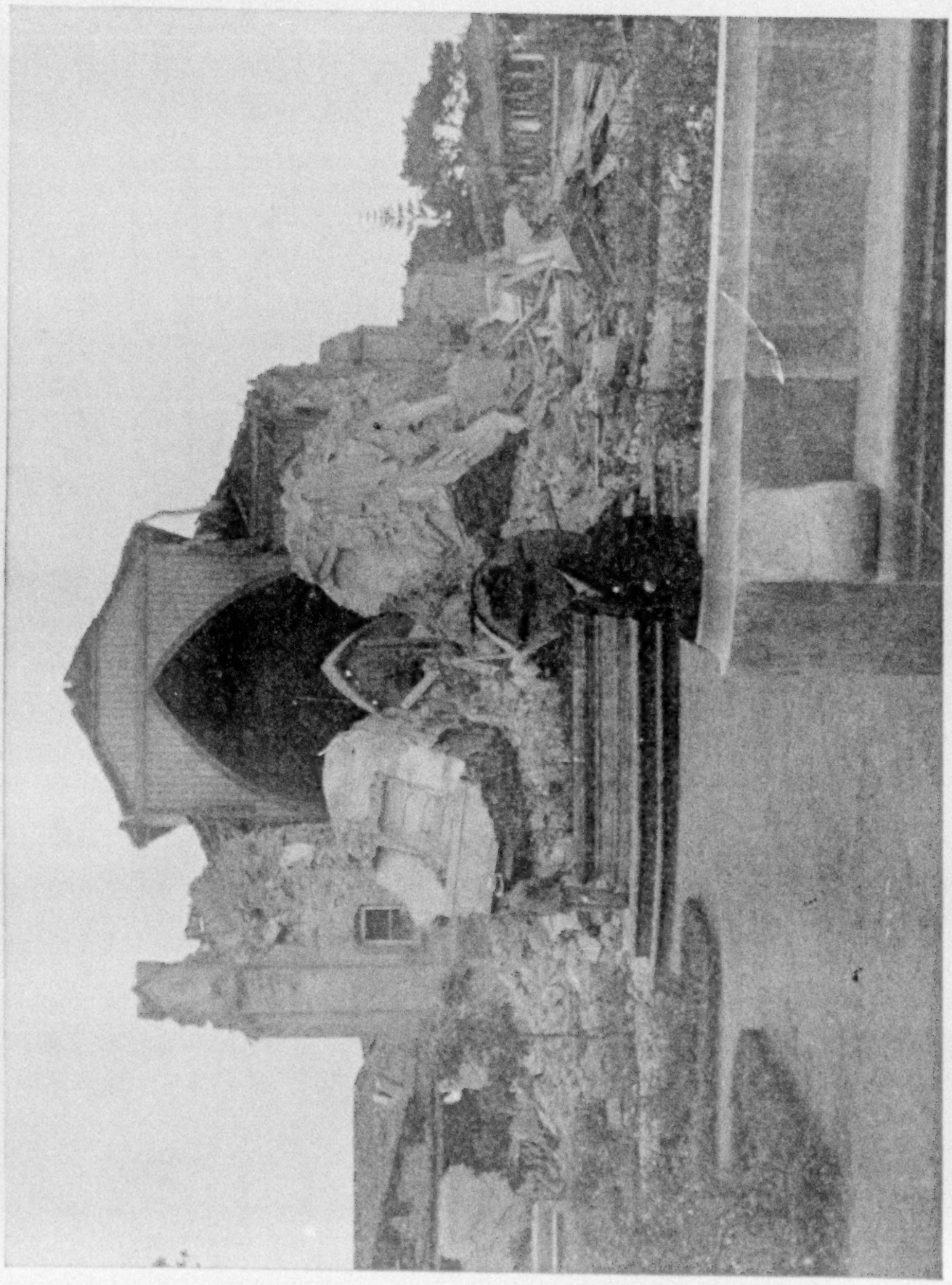
DR ANDERSON'S EXPERIENCE

Dr Luis Anderson, a well-known Costa Rican lawyer and statesman, who left Washington a few weeks before, after having won for his country fair hopes of an equitable adjustment of a long-disputed boundary question, writes:

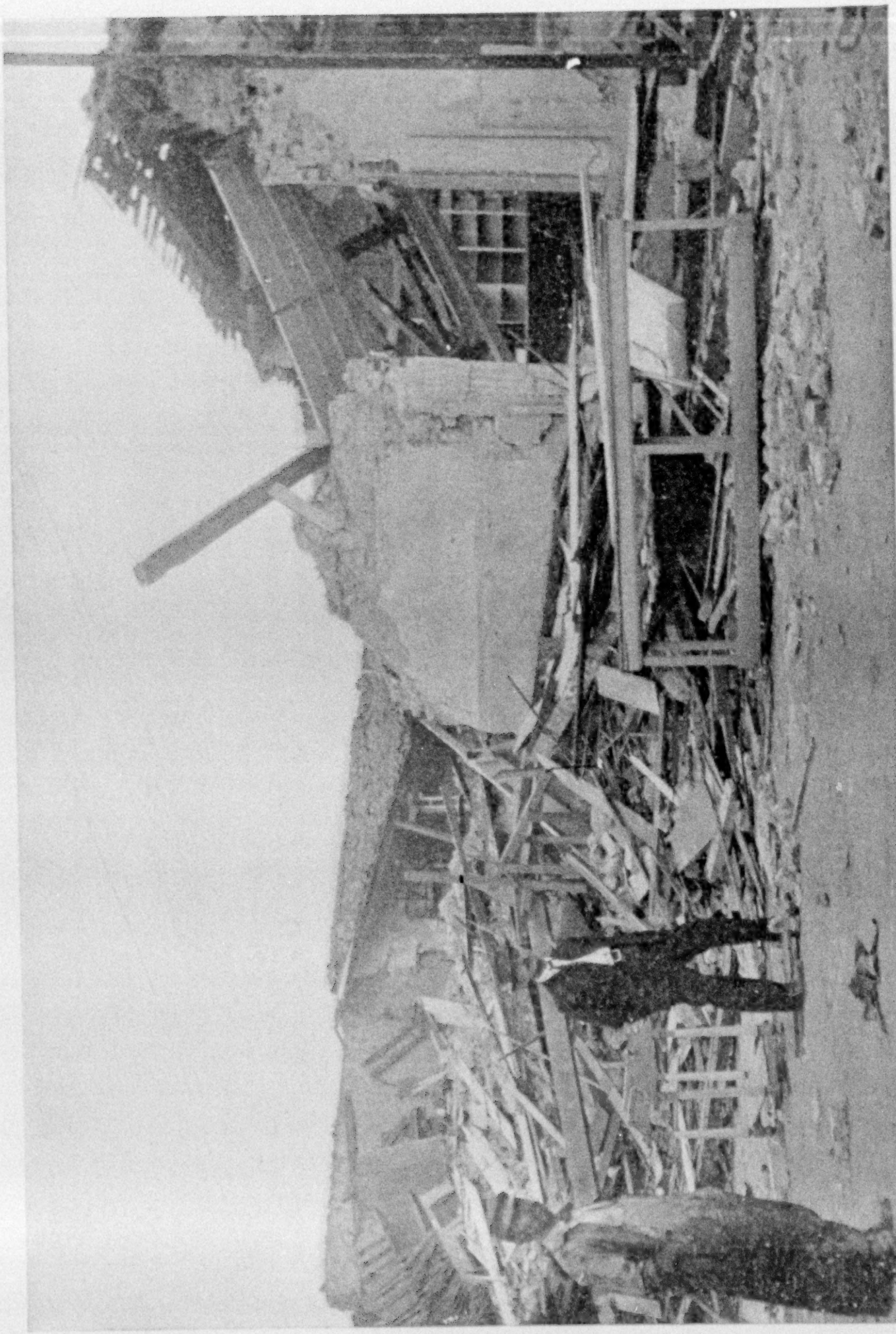
"I was just in the act of crossing the street from one sidewalk to the other when I felt something strange, like a sensation of emptiness, for the description of which no words can be found. At the same time an explosive noise, comparable to the almost simultaneous discharge of many rifles, filled the air. I shut my eyes for one second, and when I again opened them the utmost obscurity enveloped me; Cartago no longer existed. I realized that all danger of being crushed was past, since nothing had been left standing, but, at the same time, I felt as though death would come through asphyxiation. The violence of the following oscillations was such that I was thrown on the ground, where I lay stretched for a while."

Persons who were on their door-sills or walking along on the narrow sidewalk tell how they were thrown into the middle of the street, while still others who were far from any falling wall were thrown against these to a certain death.

Dr Anderson soon realized the helplessness of the stricken city, and, failing to obtain any quick means of transportation, started to walk the 10 miles to Tres Rios, about half way to San José, and which he reached a little after 10 p. m. There, after the Morse apparatus had been extracted from under the ruins of the telegraph office and reconnected, he succeeded in wiring the appalling news to the capital, which had had its share



A CHURCH IN CARTAGO, DESTROYED MAY 4, 1910 Photo from J. Fid Tristan



A HOUSE IN CARTAGO

Photo from J. Fid Tristan

A SCHOOL FOR YOUNG LADIES IN CARTAGO
The pupils and teachers were crushed in the ruins

Photo from J. Fid Tristan

A HOUSE IN THE CENTER OF THE CITY OF CARTAGO

of the calamity, although on a lesser scale.

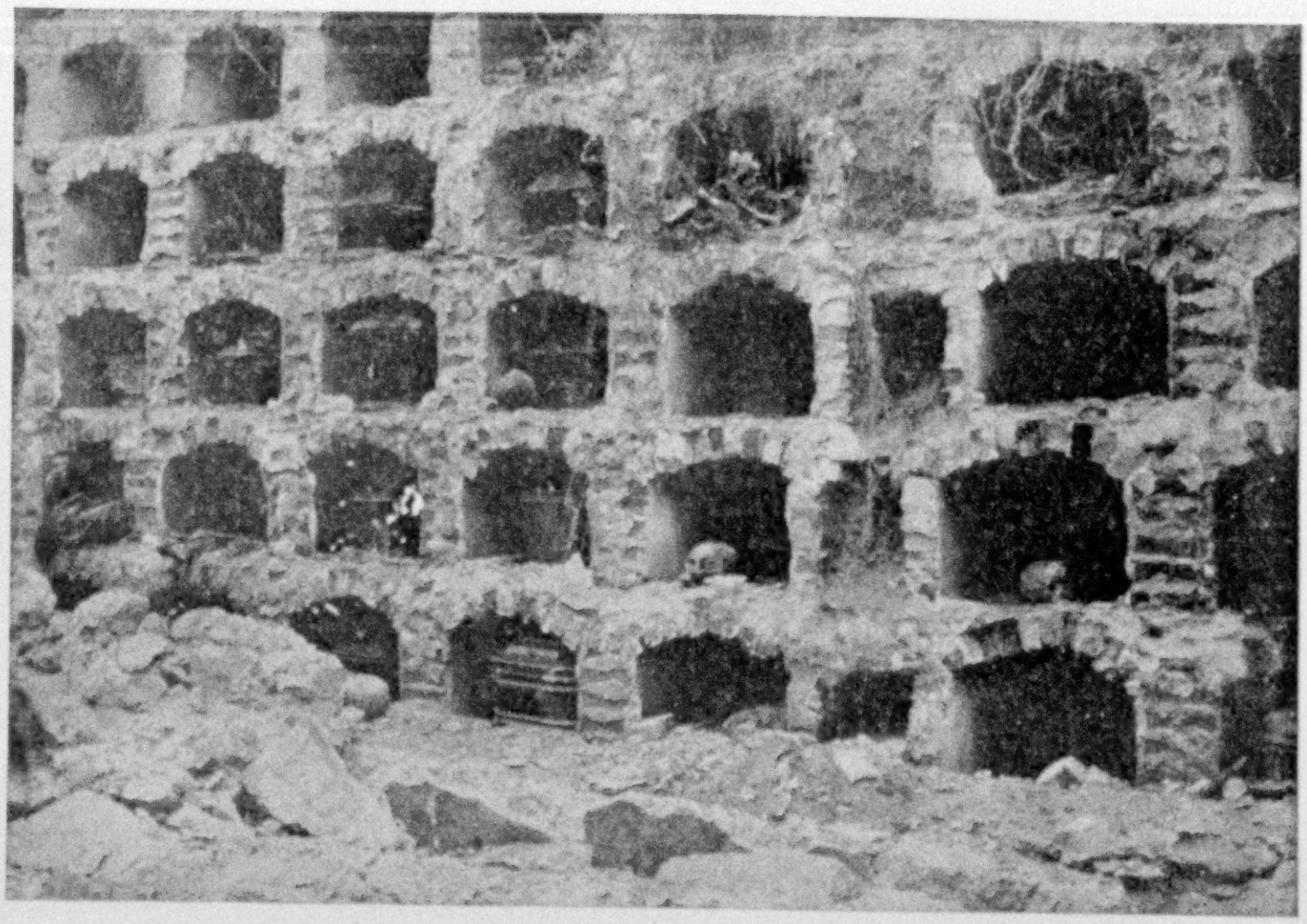
A first relief train was soon started, but at a short distance beyond Tres Rios a huge cleft in the mountain side had twisted the track in such a way as to make impossible any further progress by rail. So the little troup of physicians and other helpers, headed by the President of the Republic, had to continue their way on foot, arriving at the place where formerly had stood Cartago a little before 5 a. m., or nearly ten hours after the direful event.

Unfortunate Cartago, one of the most ancient European cities in America, has had in its past several like experiences, though none so fatal. As a consequence of the long eruption of the Irazú, accompanied by continual earth movements and subterraneous rumblings, the place was largely depopulated in 1723. It grew up again during the next century, but on September 2, 1841, it was utterly wiped out by an earth commotion of unheard of violence; the victims, however, were few, and as most buildings were very unsubstantially built of adobe and roofed with straw or tiles, the damages were of relatively little importance. So the community was again prosperous in 1851, when on May 18 it was partly destroyed by a new series of seismic disturbances.

Although it suffered less than San José from the several shocks experienced in 1888-'89, it would appear that it is located at or near the more exposed portion of the Costa Rican seismic area.

In the present case, however, the little village of Paraiso, a short distance to the east, seems to have stood on the very center; here, except for the newly erected church, the ruins of which are still partly standing, every bit of wall has been razed to the ground, while the proportion of human victims is considerably larger than in Cartago.

A few weeks ago the surrounding country was strewn with small native dwellings, most of which sheltered large families, and which also crumbled into



THE CEMETERY AT CARTAGO, SHOWING THE VAULTS BURST OPEN BY THE EARTHQUAKE

dust under the terrific blow. Today these former abodes of simple and good people look like shapeless tumuli, hiding in many instances untold victims, and all around ownerless cattle are peacefully browsing unmindful of their desolate surroundings.

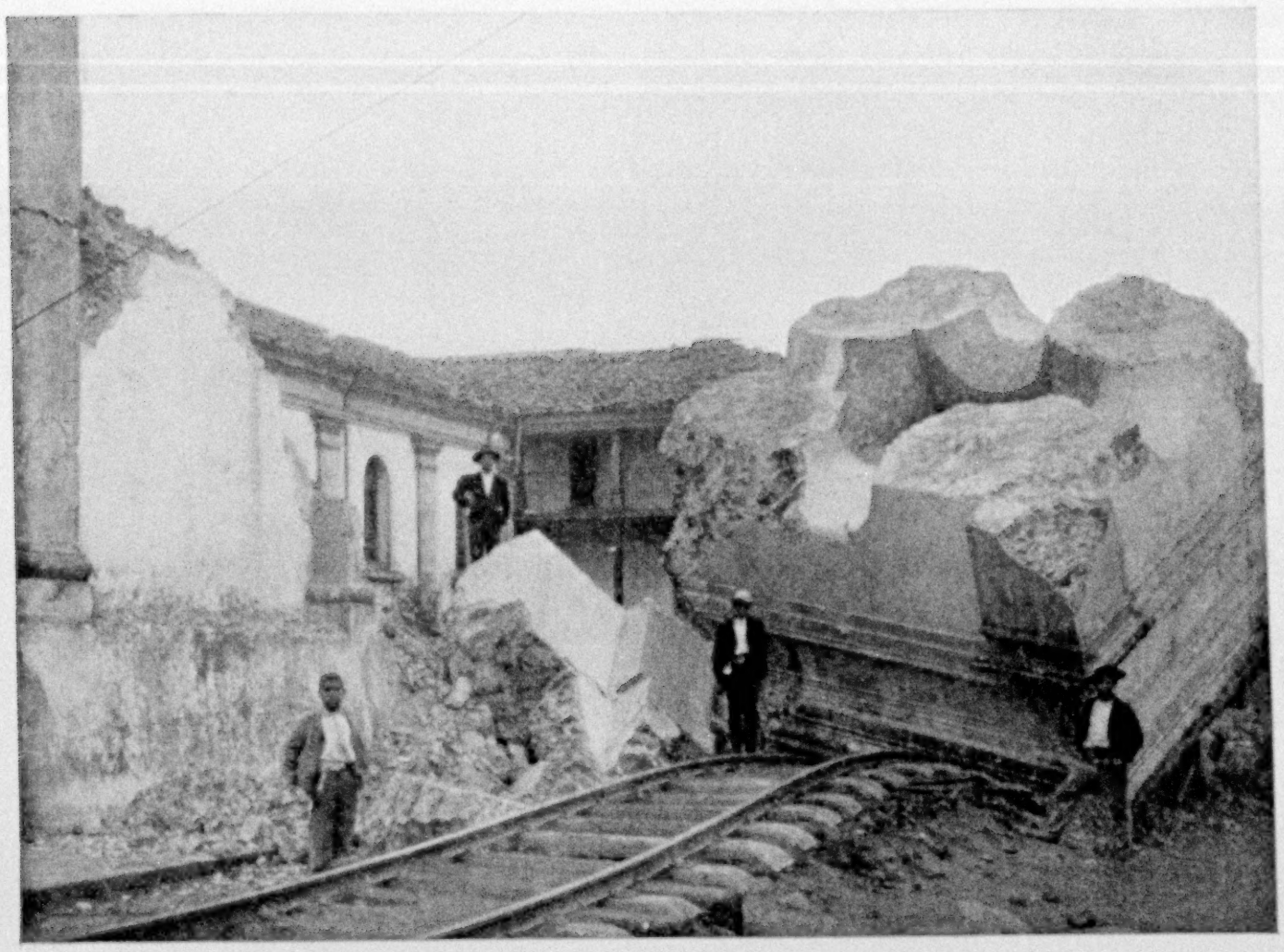
FUTURE RAVAGES CAN BE PREVENTED BY BUILDINGS OF WOOD AND STEEL

The greater part of modern Cartago was very substantially built of stone and brick with roofs of tile or of corrugated iron, and mostly on the old Spanish plan; that is to say, with four sides forming a square around one or two inner *patios* or courts. There were few two-story houses, and an exceptional number of churches, none of which have been spared. As it was explained above, the principal damage was caused by the first commotion, but the falling in of the buildings that had partly resisted continued as a result of the repeated shocks, which numbered no less than 180 during the four hours directly following the initial movement.

Ninety-six squares have been completely leveled, and the few houses left standing in the remaining part of the city are useless ruins, excepting one, which was left as a practical lesson to be applied in the work of reconstruction. This is a wooden cottage, which was indeed slightly moved from its foundations and somewhat twisted, but stood the shocks well enough not to endanger the life of its inmates.

In view of the fact that Cartago, as also the whole central plateau of Costa Rica, is constantly exposed to a repetition of the same seismic troubles, it is to be hoped that the use of wooden-frame houses will become general, and that the architectonic art will develop along the cottage and bungalow lines rather than in heavy stone or adobe construction.

In the United States, under very vari-



THE TOWER OF EL CARMEN WAS HURLED MANY YARDS (SEE PAGE 513)

able climatic conditions, there are hundreds of towns twice as large at least as Cartago or even San José that are almost exclusively built of wood, and the dwellings of which are in every respect more salubrious and more comfortable than the best houses in Costa Rica. The timber supply of the little republic will be practically inexhaustible when the extensive primeval forests that still cover three-quarters of the entire surface of the country are made accessible by the means of good roads.

The only building materials to be imported would then be, as heretofore, gypsum, iron sheeting, and hardware. No objection could really be made, except those born from a long-acquired prejudice, against the radical abandonment of the cumbrous earth or stone walls and tile roofs, and of a general style of building the origin of which can be traced to the Moors of southern Spain.

Of course this system of light wooden construction is applicable mainly to private dwellings, while a more substantial style may be desirable for public and business buildings. For these structures the steel-frame combination so extensively used in the great American cities affords adequate protection. Steel edifices of two or three stories can be made absolutely earthquake-proof as well as fireproof, and should therefore be generally adopted for schools, public offices, and other establishments where large crowds congregate. San José possesses such a school building that has withstood many heavy shocks without the least damage. It has also a private 3-story steel frame and brick structure which shows very slight damage as a result of the recent catastrophe.

But the public should be protected against the ignorance of so-called architects who pretend to make walls more resistant by including in their mass light

Photo from Rear Admiral F. Singer, U. S. N.

THE CARNEGIE PALACE OF PEACE, DESTROYED BY THE EARTHQUAKE MAY 4, 1910
Mr Carnegie immediately offered to rebuild the palace

Photo from Rear Admiral F. Singer, U. S. N.

THE CARNEGIE PALACE OF PEACE, NEARLY COMPLETED AT CARTAGO, COSTA RICA, AS IT APPEARED THREE WEEKS BEFORE THE EARTHQUAKE OF MAY 4

isolated steel rails, as may be seen, for example, in the pictures of the destroyed Carnegie building in Cartago. The frames protect the structure by their almost absolute rigidity, while isolated steel rails act under the shocks like so many springs that repeat and prolong the initial oscillatory movement, only to make more certain the total destruction of the walls they were intended to strengthen.

MR CARNEGIE'S PEACE PALACE DESTROYED

Several incidents are reported that give a further idea of the nature and violence of the seismic storm. All around Cartago the innumerable rounded stones scattered over the fields by former irruptions of mountain torrents had been collected to form the inclosures around pastures and truck gardens. These walls were completely demolished by the quakes, and many of the heaviest blocks, weighing in some instances over two tons, were moved 70 to 100 feet from their original place.

The top of the southern tower of El Carmen, one of the oldest churches, which had in the past resisted many strong shocks, was detached in a single piece and hurled to the middle of the neighboring street, where it demolished the railroad track.

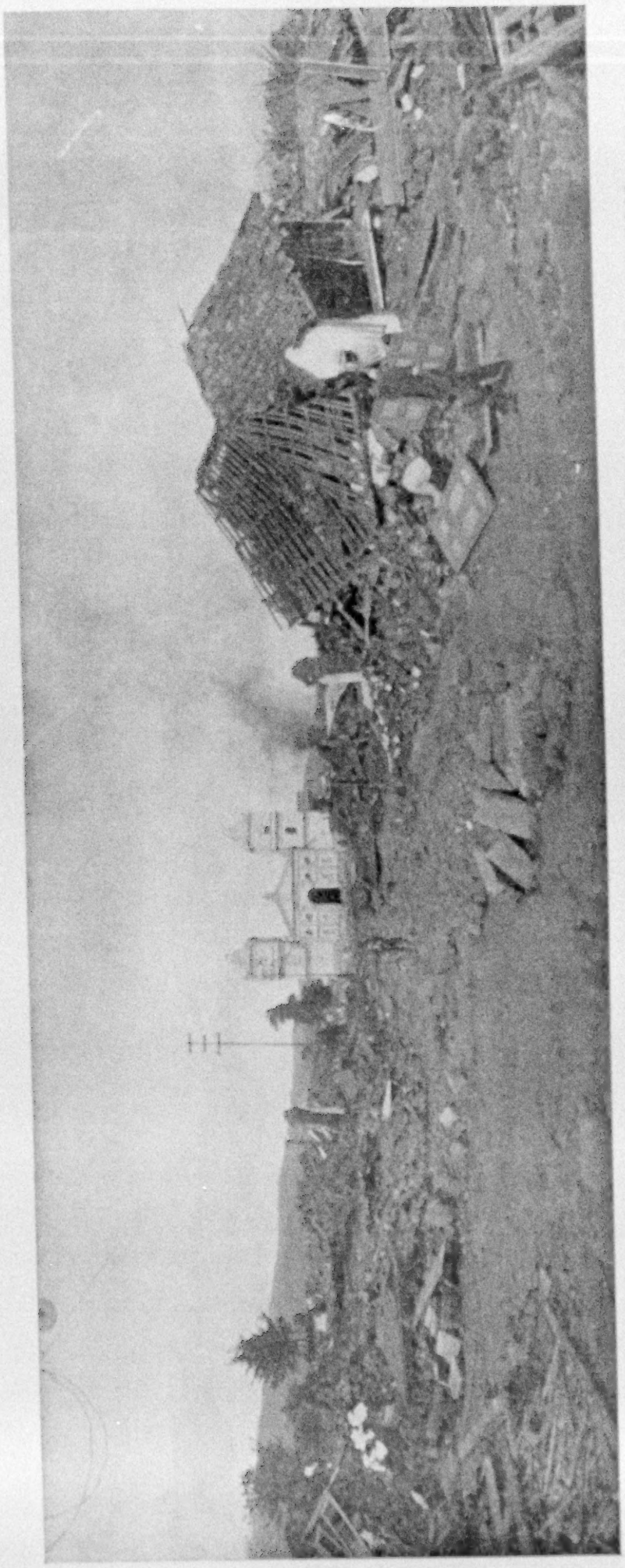
On the plaza in front of the church the statue of Don Jesús Jiménez, a former patriot and president, was merely transferred, without falling, from the center to one of the corners of its pedestal.

The palace built at the expense of Mr Andrew Carnegie, to be the abode of the Central American Court of Arbitration, and which was soon to be dedicated, was converted into a shapeless heap of rubbish but for its foundation and the southern front wall. The new sewerage and water systems, on the other hand, do not seem to have suffered.

Going westward the extent of the damage becomes gradually less until it is almost insignificant at Alajuela, at the

"LOS ANGELES" Photo from J. Fid Tristan

One of the richest churches in Cartago. The treasures kept in this church are worth many thousand dollars



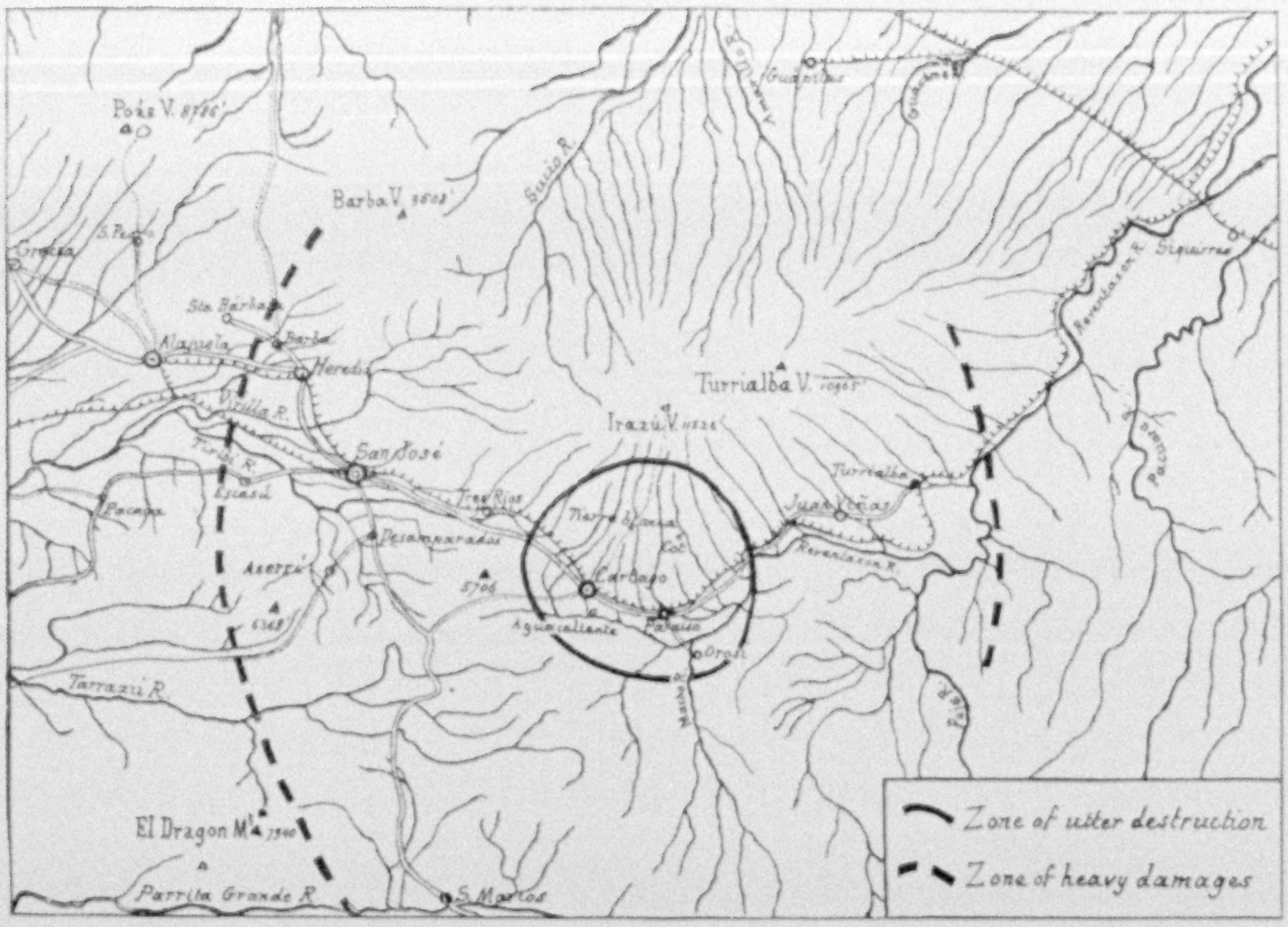
PANORAMA OF THE RESIDENCE SECTION OF CARTAGO AFTER THE EARTHQUAKE OF MAY 4, 1910

foot of the Poás Volcano. In San José the material losses have been considerable. Among the public property, the four buildings of the boys' high school are practically out of use; two other school buildings have lost their upper stories; the old presidential mansion, of late Comandancia de Armas, is a wreck; the new penitentiary building is heavily damaged, and the Supreme Court of Justice had to be evacuated. Of the private residences, it is said that 80 per cent could not possibly stand a repetition of the trial of April 13 last.

At the latest news, about May 23, seismic movements were still felt, although with a reduced intensity, and 6 to 10 shocks were reported daily. All seem to indicate, however, that the worst is over.

During the night of May 13-14 several persons affirmed having seen from San José glaring flames issuing from the volcanoes, disagreeing only as to the identity of the crater, which some called Irazú and others Poás. These two are located, as may be seen from the map, in quite opposite directions. The contradiction is now explained by the fact, attested by many people, that at the moment of the strongest shock a brilliant meteor crossed the zenith exactly from east to west, and further notices from the Pacific coast indicate that that body fell in the middle of the Gulf of Nicoya.

As a matter of fact, none of the Costa Rican volcanoes have shown of late any sign of unusual activity, and the current notices about lava eruptions and the formation of new craters should be accepted with caution.



MAP OF THAT PART OF COSTA RICA WHICH WAS OVERWHELMED BY THE EARTHQUAKE OF MAY 4, 1910, BY H. PITTIER

As usual on such occasions, many instances of miraculous rescues are cited, and a large number of persons at first thought to have perished turned up safe and sound. Nevertheless, the ruins of the old city had already given back over 600 bodies at the date of our latest information, and many more will remain to rest awhile under the débris, lucky if death came instantly and not, as it has been found in several cases, after hours of excruciating agony.

In Paraiso, over 120 dead have been removed from the ruins, and, if the casualty lists of Aguacaliente, El Tejar, Tierra Blanca, Cot, San Rafael, and other villages and hamlets or isolated houses are added to the former, the total number of the victims will certainly reach far above 1,000. Besides, it is feared that many of the 500 or 600 patients filling the hospitals in consequence of the earthquakes may not recover.

The material losses, reaching a sum well up into the millions, may not seem very great to an American, but they are simply crushing to a little country like Costa Rica, especially at the present time, coming upon her as it has in the most serious and trying financial crisis she has ever experienced in her history.

THE PEOPLE OF COSTA RICA ARE VERY DIFFERENT FROM OTHER CENTRAL AMERICANS

The sympathy of the American people and of all civilized nations will certainly go out to the unfortunate little Republic, which is attractive not only on account of its natural beauties, the richness of its flora and fauna, the striking contrast between its warm and fruitful coastal plains, which yield yearly millions of bunches of bananas, and its picturesque mountains, producing coffee of the very finest quality, as well as nearly every

product of the temperate zone, but also because of the history of the past half century of steady fighting, not bloody and cruel, nor for power, nor for the satisfaction of petty ambitions, but for the conquest of knowledge and the enlightenment of its citizens.

For Costa Rica stands alone among the turbulent Central American States in all things pertaining to freedom, self-government, and progress. The country was colonized at first by people from the ancient Spanish province of Galicia, and the colonists have not, as in many tropical countries, amalgamated with the aborigines; they have consequently kept to the present time the original characteristics, as well as the qualities of their race, and the inherent grace and charm of their ancestors. They are laborious, progressive, and peace-loving, and have a record of a long period of absolute internal tranquillity.

Three-quarters of the population inhabit the so-called Central Plateau, the climate of which is the most perfect realization of perpetual spring. The agriculture of this region is very highly developed, the principal product being coffee, maize, beans, and potatoes. The land is divided into exceedingly small holdings. Almost every peasant is a land-owner.

The Atlantic coast, warm, humid, and rather unhealthful, but very fertile, produces on a very large scale bananas and cacao, the exploitation of which is unfortunately tied by contracts with foreign companies. In the banana plantations, covering over a hundred square miles, the laborers are mainly West Indian negroes, the only human beings able to stand hard and continuous work under the climatic conditions.

The Pacific coast does not differ much from the interior but for its warmer temperature and its extensive grass-covered savanas, in which stock raising is the chief industry.

Except for a small part, located in the western province of Guanacaste, the 360,000 inhabitants are crowded into a narrow belt extending across the country from Ocean to Ocean, along the railroad which connects Port Limon and Punta Arenas. The remaining part of the State—that is to say, four-fifths of its entire surface of about 18,400 square miles—is a wilderness, with but a handful of hardly half-civilized Indians inhabiting the valleys of Diquís and Talamanca.

Of the five Central American Republics, Costa Rica was the first to be connected by a railway with the eastern coast, thus getting into close touch with European civilization. In many respects this was a source of real benefit to the country. The Costa Ricans became great travelers. They sent their sons to be educated in foreign schools and universities, and on their return these diffused among their fellow-citizens new ideals and more advanced moral standards. Foreign teachers and professors were brought and kept long enough to establish on a solid foundation an excellent school system, so perfect indeed that illiterate men or women are hard to find, while books and newspapers are common even in the most remote hamlets. The scientific study of the climate and the natural resources of the country was carried on at the expense of the government, and the introduction of modern arts and agricultural methods and implements were given every encouragement.

Sad to say, the uplift in the general education has awakened misdirected ambitions among the poorer classes, attracted the peasants to the cities, created a greed for government positions, these having consequently multiplied beyond all reasonable limits, with a corresponding and necessary increase of public expenditures.

Moreover, on account of a heavy public debt, the result, partly of unscrupulous speculations of foreign and native financiers and of unwise undertakings, the government has become entangled in heavy financial difficulties that have brought the country to the verge of bankruptcy. This deplorable economic situation has been aggravated of late by

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A COFFEE PLANTATION IN COSTA RICA

Photo by Rev. Grinter

Banana trees protect the coffee bushes from the intense rays of the sun

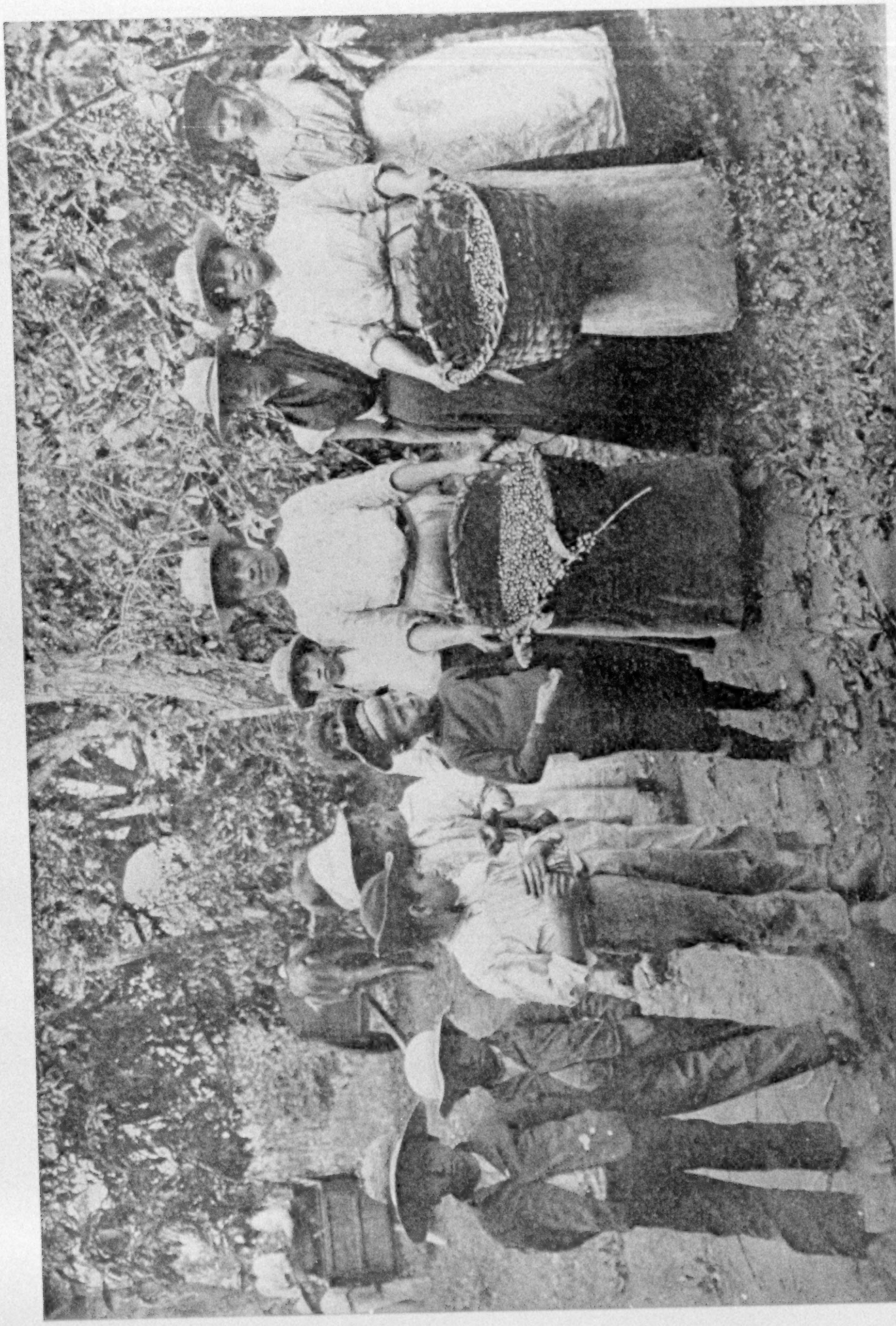
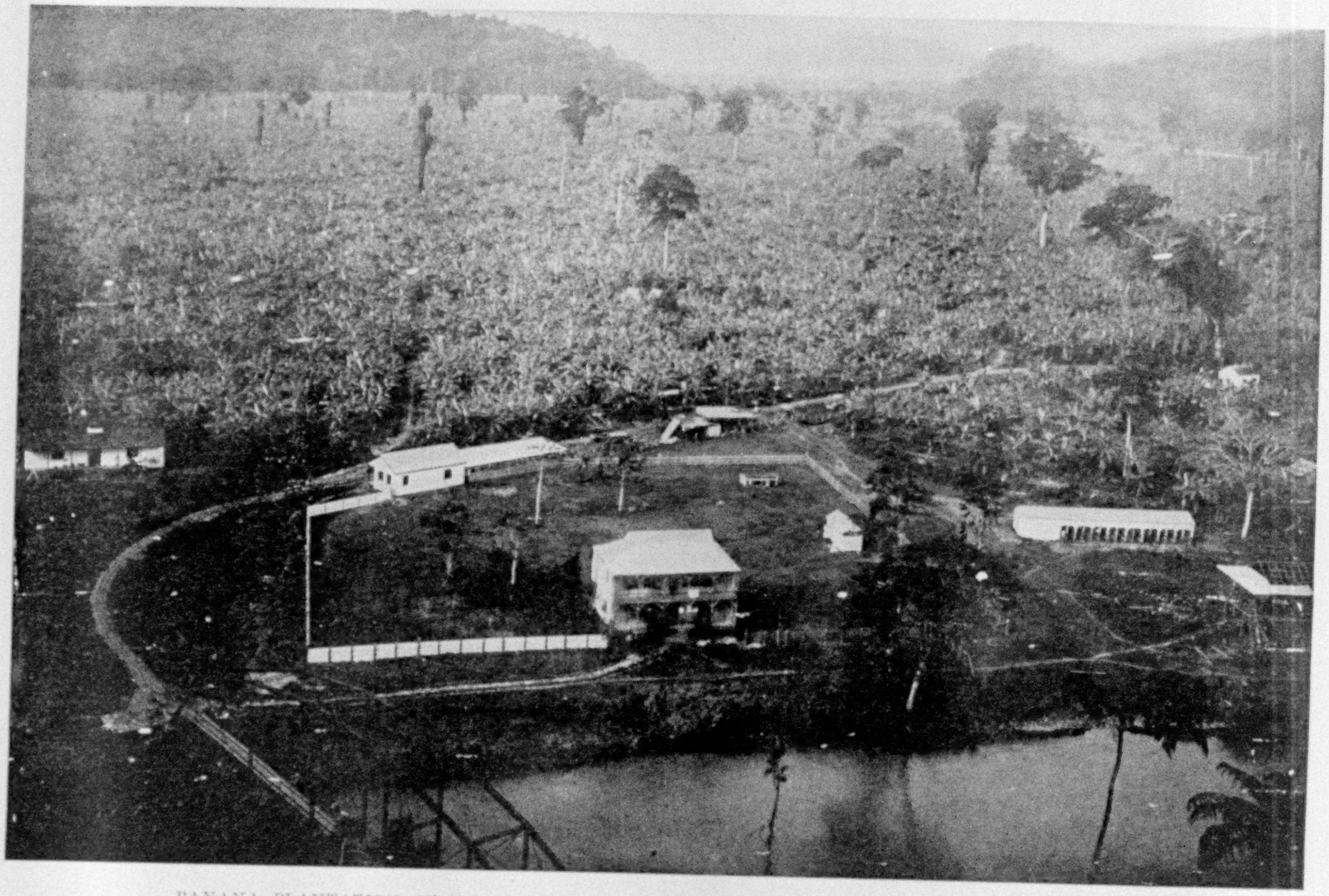


Photo by Rev. Grinter

PICKING COFFEE, COSTA RICA

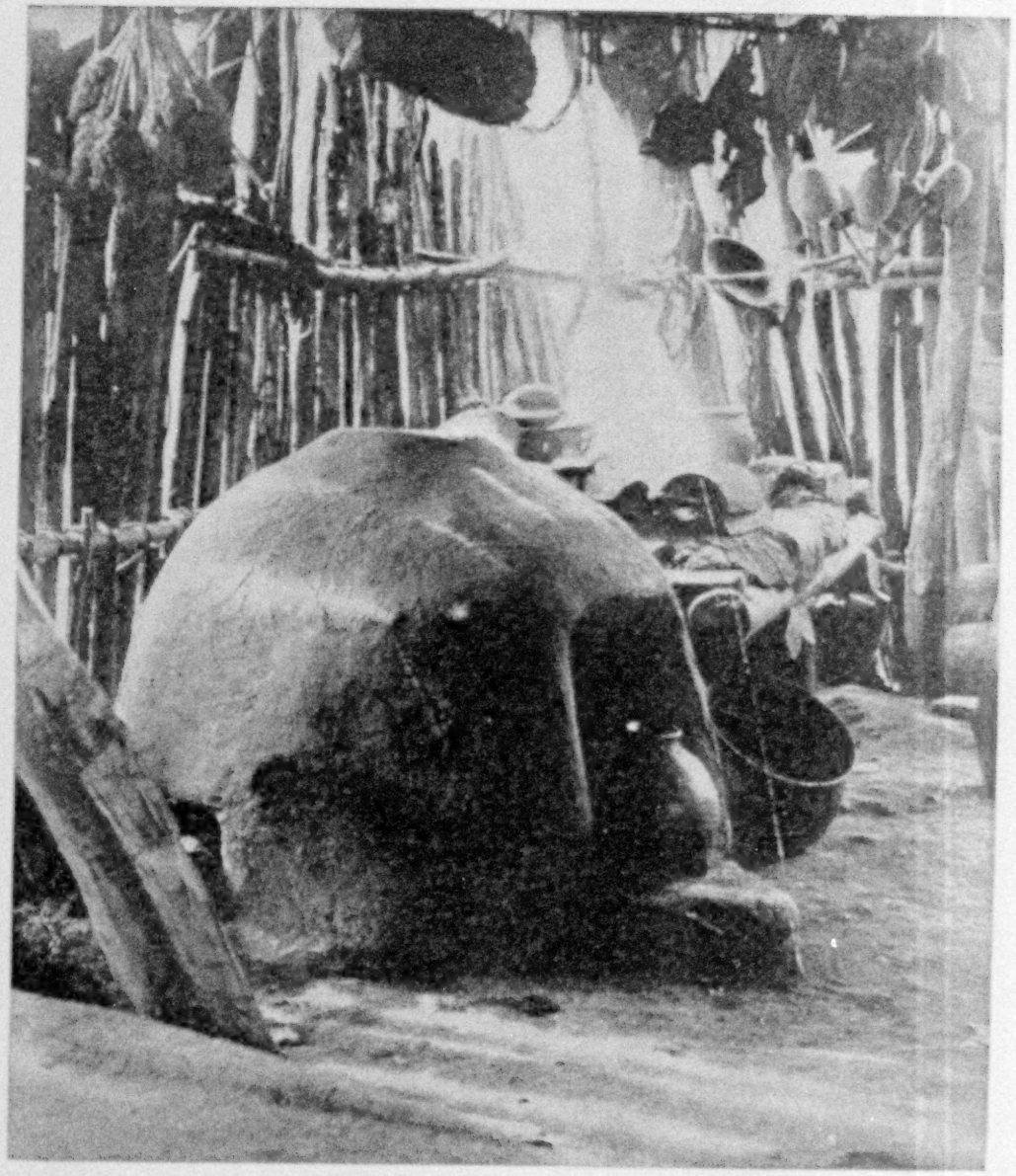


BANANA PLANTATION OF THE UNITED FRUIT COMPANY AT CHIRRIPÓ, NEAR PORT LIMON Photo by H. Pittier
Zent River in the foreground, Chirripó River and last spurs of the Cordillera in background

SHIPPING THE BANANAS, COSTA RICA

Photo by H. Pittier

POLISHING A LARGE JAR WITH A STONE



THE KILN FOR BAKING SMALL PIECES

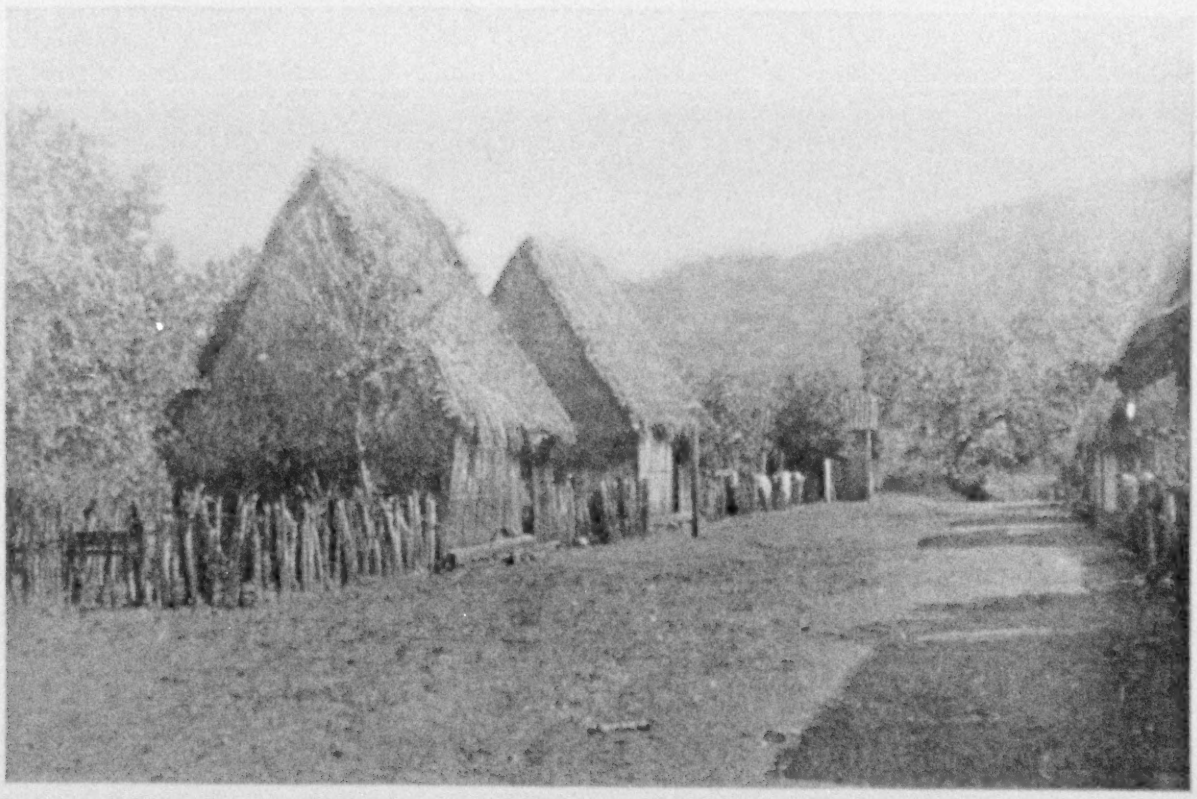
Photos by H. Pittier

MAKING POTTERY IN COSTA RICA

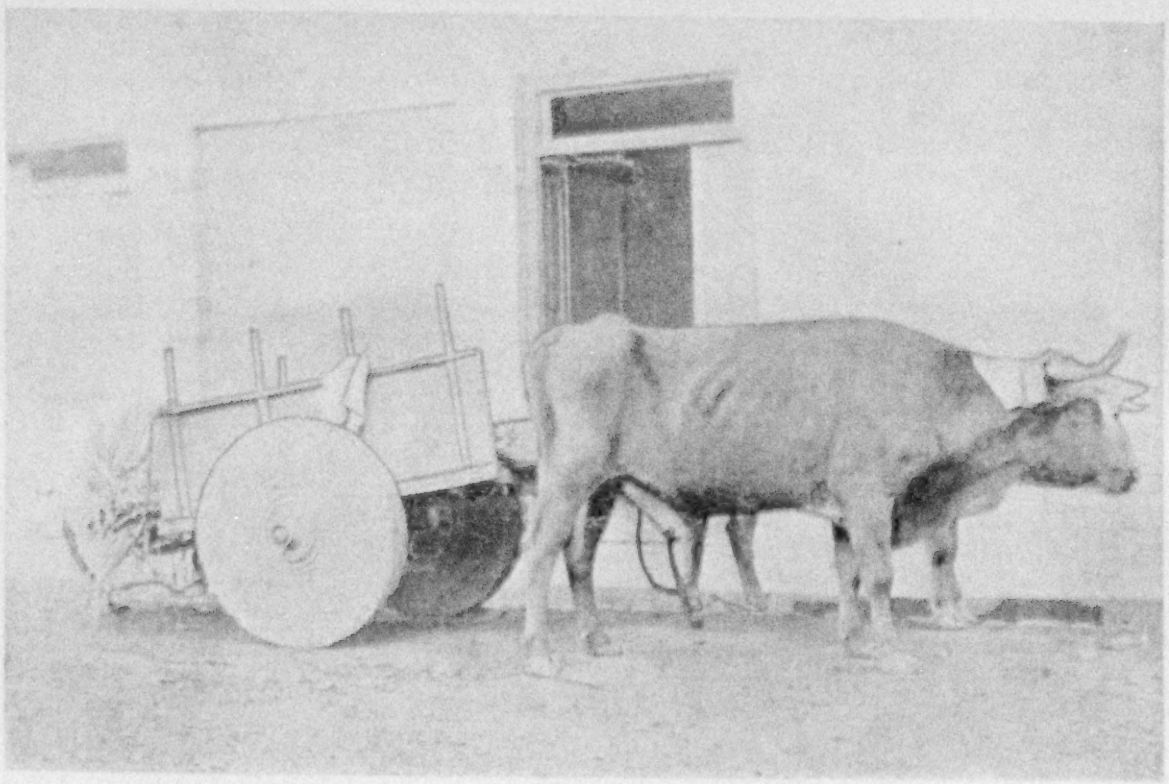
MODELING

BAKING A LARGE POT

Photos by H. Pittier



A STREET OF NICOYA, A PACIFIC COAST VILLAGE



NATIVE CART, COSTA RICA

Photos by H. Pittier

several consecutive failures of the coffee crop, by unusual rainy seasons, resulting in inundations, destruction of railroads, and depression of the banana trade.

A catastrophe like that which has just befallen Costa Rica is appalling enough whenever it occurs, but it could not have come at a more unfortunate time in the life of that interesting spot of the American Tropics.

THE ERRATIC

By O. A. Ljungstedt, of the U. S. Geological Survey

WHENEVER your vacation rambles have taken you to one of the Northern States of the country, you have no doubt often been struck by the sight of some unusually large boulder perched on the top of a mountain, or resting, maybe, in such a nicely balanced position by the very edge of the sea that a dashing wave may rock it to and fro.

Examine one of these boulders more closely and you will find several things to distinguish it from others that you may have noticed south of the area shown as white in the map on page 526. Should the rock on which the boulder lies be bare of soil, it will often be found to be of a different kind than that of which the boulder is composed. Thus the boulder itself may be of granite and rest on a surface of limestone, shale, or sandstone.

You will also often find this bare rock polished to a remarkable degree, or marred by scratches, and even deep grooves running in a more or less parallel direction, known as glacial striæ.

To understand how a block of granite as large as a small cabin could be lodged on top of a mountain when there is no similar rock within a hundred miles or more, we must trace its history back to a time at least 200,000 years ago, when the geologic period called the Tertiary was drawing to its close. The first fact to attract our attention, could we have taken a bird's-eye view of the northern part of our continent at that time, would be its greater extent than at present. Looking eastward we would see the shoreline extending in places a hundred miles beyond the shoreline of today, and in vain would we scan for the islands, bays, and reaches that now lend such enchantment to our picturesque coast.

Northward the land probably stretched unbroken over the present Arctic archipelago, and connected on the east by way of Greenland, Iceland, and the Scandinavian Peninsula with Europe and on the west by closing of Bering Strait with Asia.

This circumstance had a very important bearing on the fauna of that day, as it enabled the animals from the one continent to cross to the other. Making a closer inspection of the landscape beneath us, we would be surprised at the total absence of the smaller lakes that now are its most characteristic feature. Even the Great Lakes were missing, with the possible exception of Lake Superior, while in the valleys in which these latter now lie flowed rivers belonging to one or more systems.

The mountain groups of today we would recognize at once, notwithstanding their somewhat more rugged outline, and the same would be true in the case of the rivers. While we would see a number of them in strange courses, the master streams we would know at first glance. For millions of years these had been cutting their channels undisturbed, until at the close of the Tertiary a new impetus was imparted to them, owing to the recent rise of land and the ever-increasing humidity of the climate. So we would probably see them turbulent and swollen and the sides of their water-courses often precipitous and jagged, overhung in

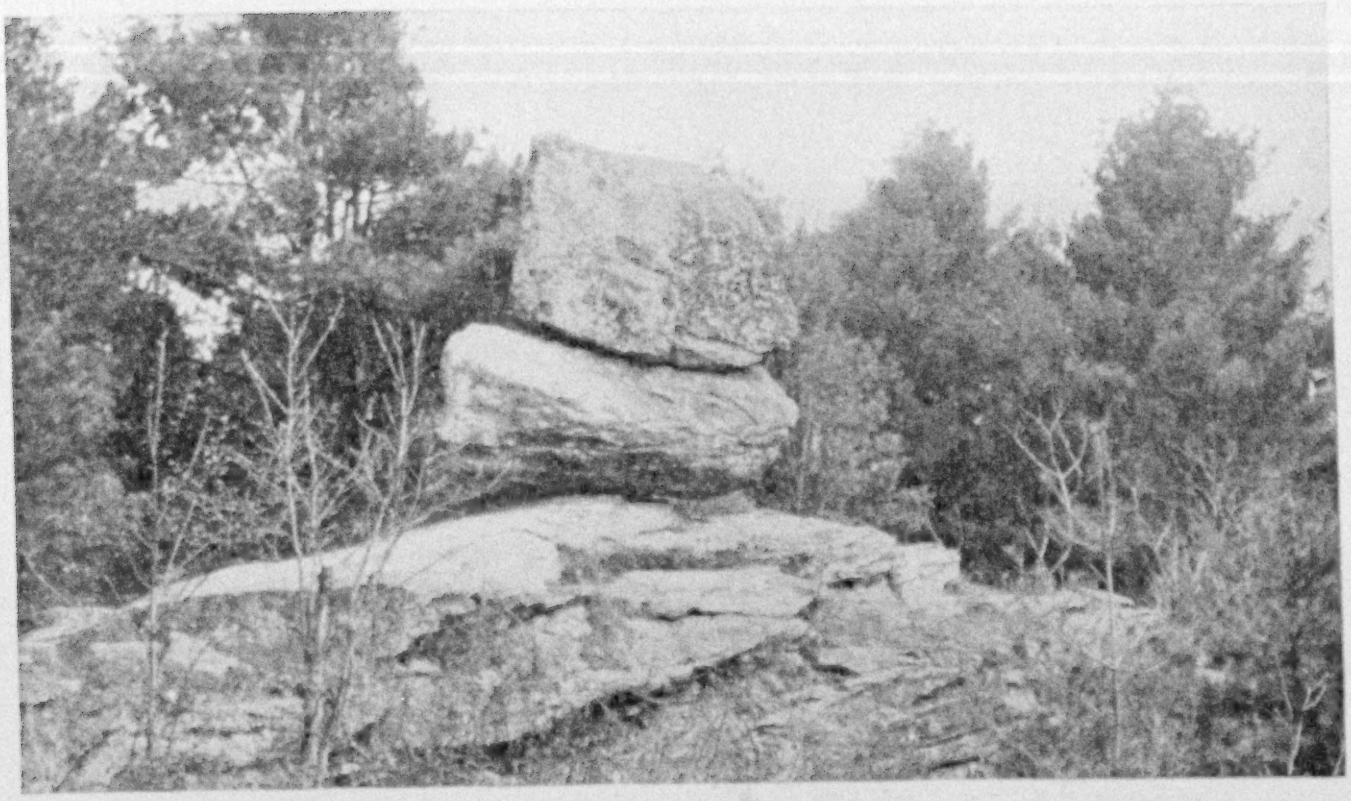
MAP OF NORTH AMERICA AT THE TIME OF MAXIMUM EXTENT OF THE ICE

Showing also the approximate outline of the continent. There were minor ice-centers, not indicated, over most of the high mountain ranges of the west from which glaciers descended the valleys and in some places deployed on the plains.

places by great ledges and loose blocks readily dislodged by the least force.

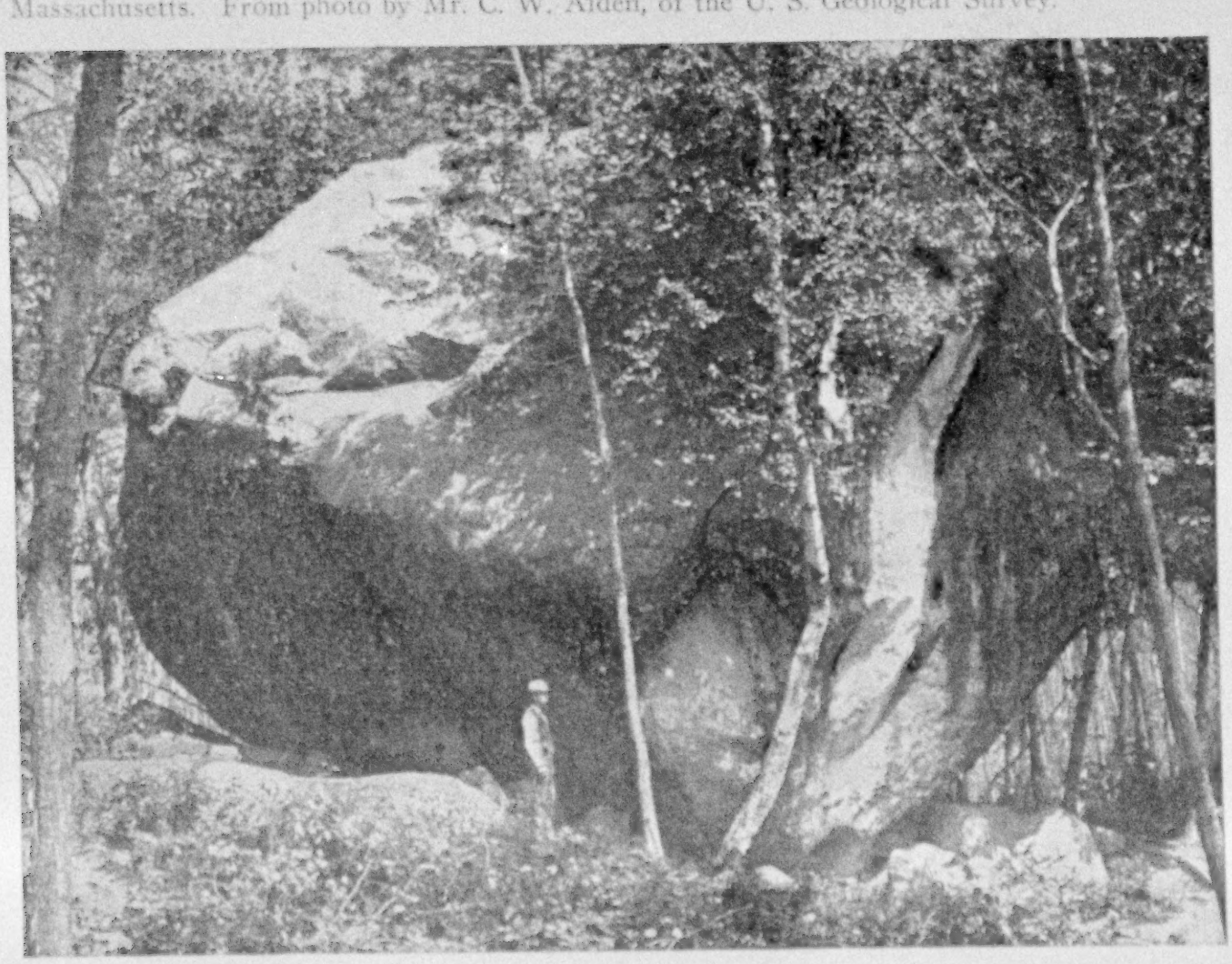
The climate over the whole continent was semi-tropical, or at least temperate, and such plants as the fig and great redwoods of California grew as far north as Greenland and Iceland. And through the almost endless woods of the north roamed herds of mastodon and other herbivore of great size, together with such beasts of prey as the now extinct saber-toothed tiger. But we would find no trace of man.

Over this strange and magnificent world the Ice Age swept down so suddenly, as geologic time is reckoned, that



A VERY REMARKABLE CASE OF ONE ERRATIC SUPERIMPOSED ON ANOTHER

The upper one of coarse granite, the lower one of granite gneiss resting on a granite ledge. They are situated at Sunnyridge farmhouse, 3 miles west-northwest from Barre, Massachusetts. From photo by Mr. C. W. Alden, of the U. S. Geological Survey.

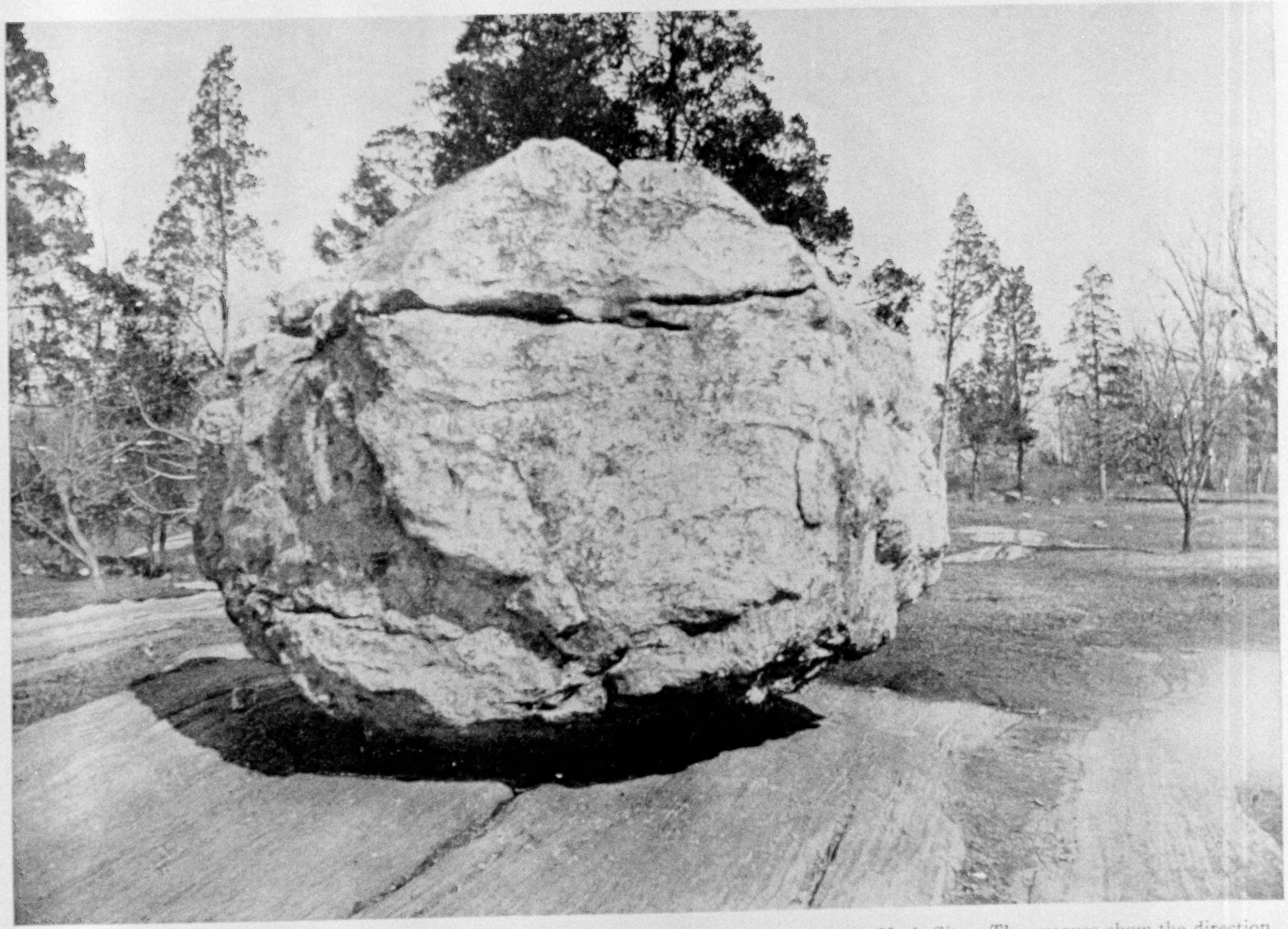


THE WASHINGTON BOULDER NEAR CONWAY, NEW HAMPSHIRE

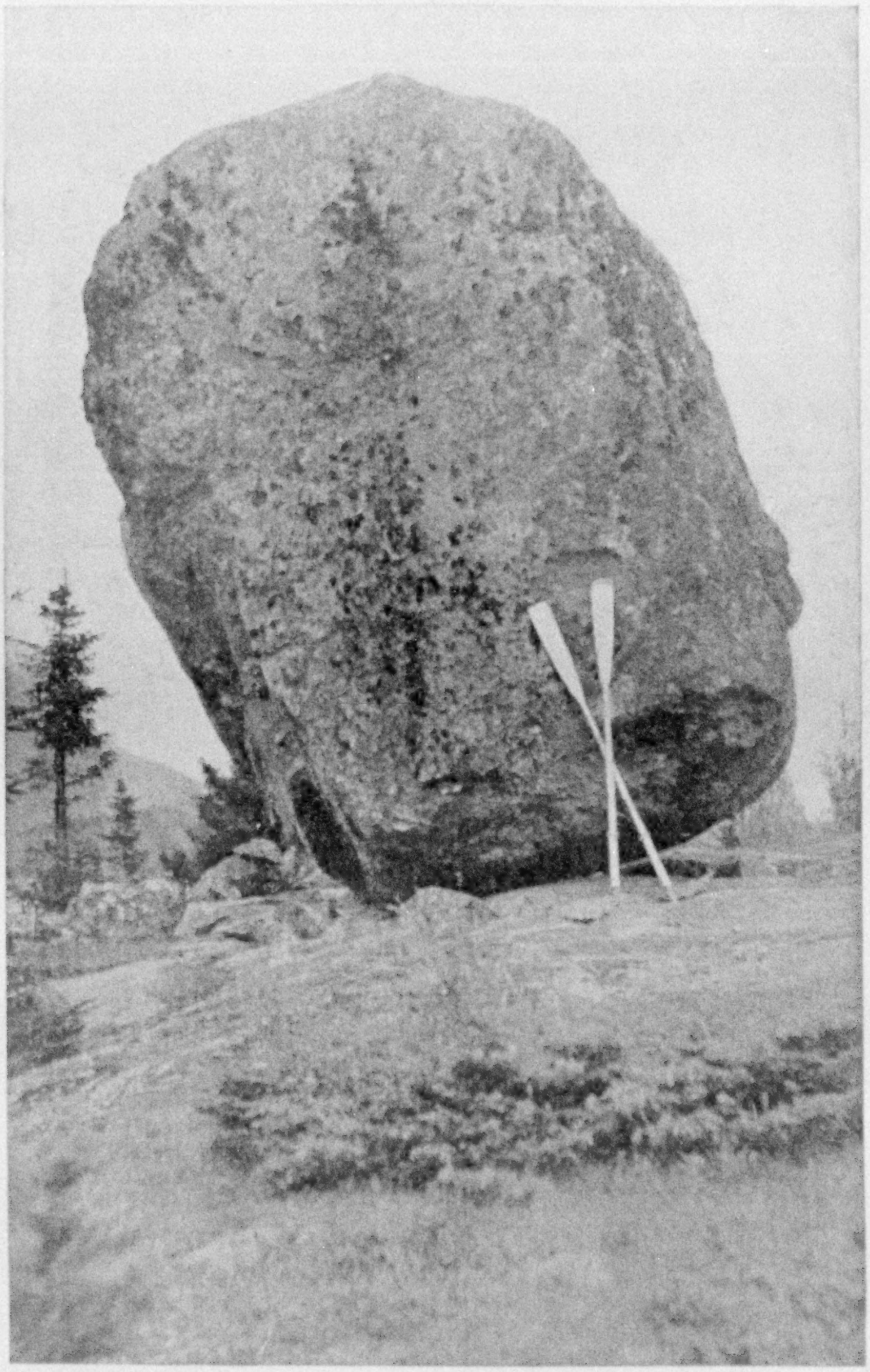
From negative in possession of the Geological Society of America

BOULDER ON GLACIATED SURFACE NORTH OF BLOODS, CALIFORNIA

This is the work of glaciers descending the valleys from one of the local ice-centers south of the continental cap. From photograph by H. W. Turner



An erratic often lies on a smooth and striated surface as does this one in Bronx Park, New York City. The grooves show the direction in which the ice moved. From negative in possession of the Geological Society of America



BOULDER AT SOUTHWEST END OF MEGUNTICOOK LAKE, WEST OF CAMDEN, MAINE

From photo by E. S. Bastin, of the U. S. Geological Survey

most of the then existing animal and plant forms, pushed south before its advance, had not time enough to adapt themselves to their new environment, and therefore became greatly altered or exterminated.

As yet there has been no good reason assigned for a change that in a comparatively short time transformed the semi-tropical climate into that of Greenland of today. Probably a combination of circumstances brought it about.

Be that as it may, the fact remains that over certain centers—one on the east of Hudson Bay, the Labradorian; another on the west of it, the Keewatin; and a third in the Canadian Rockies, the Cordilleran — snow, gradually changing into ice, accumulated year after year to such immense thicknesses that finally, impelled by its own weight, motion began, and three giant glaciers crept out over the adjacent country. These finally joined into a continental ice mass that at its greatest extent covered two-thirds of North America—an area of about 4,000,000 square miles.

While there may have been some difference in time at which the various ice centers reached their greatest development, we will be very near the truth in saying that from the southern limit, shown on the map, northward the ice lay in one unbroken expanse, with the exception of the so-called Driftless Area and possibly one of the highest mountain peaks in the East. It is calculated that its thickness at the two eastern centers must have been something like 5,000 to 10,000 feet.

On its way from the north the ice mass gathered to itself immense quantities of soil and loose rock, which were carried along with it. Occasionally huge blocks of rock from mountain slopes and stream bottoms were clutched in the firm grip of the ice and carted for hundreds of miles. Frequently the ice would lift great boulders from the bottom of a valley to the top of a mountain.

Presently the ice began to retreat before a more congenial climate. It was not at first, however, a steady retreat, as not less than four times the ice again advanced after having almost vanished, and each time it was followed by animals and plants adapted to the semi-frigid climate at its edge. During one of these interglacial epochs man appeared upon the scene.

But as the ice melted and disappeared the earth and rocks which it carried were dumped, sometimes as an even mantle, but more often in hills and ridges.

A PRIMITIVE GYROSCOPE IN LIBERIA

By G. N. Collins

THE recent applications of the gyroscope in the Brennan monorail and as a means of steadying steamships, as well as the present popularity of toys based on this principle, recall a gyroscopic toy in use among the Golahs of Liberia, West Africa. Certain members of this primitive tribe have developed a very remarkable skill in manipulating this top-like toy, which they keep spinning for any length of time in midair merely by whipping it.

Interest in this primitive gyroscope has been further increased by the botanical identification of the fruit from which the tops are made. Mr W. T. Swingle, of the Department of Agriculture, points out that these hard-shelled, spherical fruits belong to the genus Balsamocitrus, a very near relative of the ball fruits of India and a more distant relative of the orange.

These fruits may well be described as hard-shelled oranges (see page 532). They are from three to five inches in diameter. The shell is very hard and from one-quarter to one-half inch in thickness.

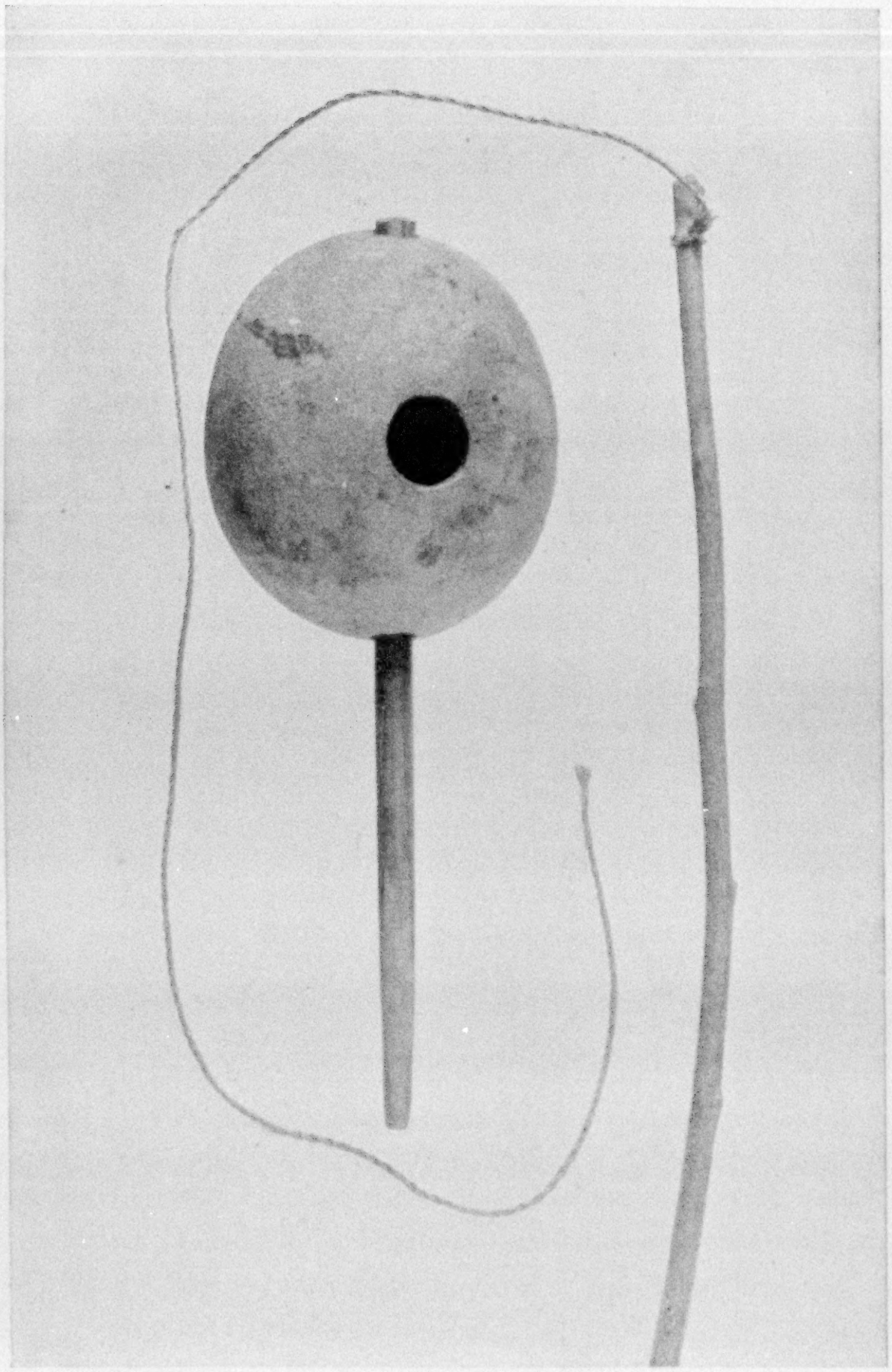


Photo by G. N. Collins

LIBERIA GYROSCOPIC TOP, MADE FROM THE FRUIT OF A HARD-SHELLED ORANGE

The top is made to spin rapidly in midair by the aid of the whip

Photo by G. N. Collins

METHOD OF STARTING THE GYROSCOPIC TOP

The lash of the whip is wound around the body of the top. A sudden upward motion throws the top into the air and starts it revolving

Photo by G. N. Collins

LIBERIAN NATIVE SPINNING THE GYROSCOPIC TOP

The top can be seen in the air above the Golah man's head. The top is kept in the air by repeated strokes of a small whip

The top is formed of one of the fruits from which the interior has been removed, together with a round stick about one-half an inch in diameter and eight inches in length. The stick passes through the center of the fruit, projecting only on one side. A hole is also cut in the side of the fruit so that the top produces a low, mournful sound when spinning rapidly.

The whip by means of which the top is kept in the air consists of a stalk about one foot in length to which a string about 18 inches long, made from the fiber of the wine palm, is tied as a lash.

The method of starting the top is shown on page 533. The lash of the whip is wound around the body of the top, making a little more than one turn. The top is then placed on the ground with the stem to one side. The whip is given a quick upward motion, throwing the top into the air at the same time, imparting to it a spinning motion. As the top drops within reach, but before it touches the ground, it is struck with the whip in such a manner that the lash winds around the stem close to the head. The stroke is immediately followed by another upward motion, which again throws the top up and makes it revolve still faster.

This operation is repeated rapidly, the top going faster and faster with each stroke, until it begins to emit a low musical note. The illustration on page 534 shows the top in the air.

The performance may be likened to the operation of the popular toy called "diablo," but the skill required is immensely greater. The "diablo" is thrown up from the middle, and the ends on either side of the string, being of equal weight, balance each other, while in the Liberian toy the weight is practically all on one side of the place struck by the whip.

Skilled performers have no difficulty in keeping the top in the air for any length of time desired. The performance is varied by catching the top on the stock of the whip and slowly tilting it until the end of the stick rests on the ground, where it spins for some time like an ordinary top. From this position, while still spinning, the top can again be thrown into the air by the whip and the whole operation repeated.

When first seen it seems incredible that the top can be thrown up by the stem, which is on one side, without twisting the top into another position. There can be no doubt that the same principle is involved as when a gyroscope is maintained in a horizontal position, although supported by only one end of the axis.

The skill required to operate this top is possessed by very few members of the tribe. Repeated and patient efforts on my part to acquire the knack were futile. I was never able to keep the top in the air for more than two or three strokes of the whip, and was never able to make it revolve fast enough to produce a sound.

Bwingba, the Golah man who is shown operating this top in the illustration, was the only native I met who possessed the necessary skill. That this man had more than ordinary ability was shown in other ways. His house was the best in the town, he could swim faster and dive farther than any one else, and he was always chosen for the dangerous work of taking the big canoes from the upper reaches of the Saint Paul River through the rapids to the lower river. This skill in aquatics was supposed to be explained by his having a hippopotamus for a totem.

The sound produced by this top is believed by the Golahs to be distasteful to the ground hogs, which often do considerable damage to cultivated fields. This means of driving away pests is considered so effective that men able to perform with this top are in great damand, and are often called a distance of two or three days' travel to rid fields of these pests.

XUM

EUROPEAN TRIBUTES TO PEARY

ALL the nations of Europe united to give Commander Peary a royal welcome on his visit to England and the Continent in May and early June. Emperors and kings, scientists, the public, and the press were all equally cordial and enthusiastic in their congratulations and tribute to his perseverance and success.

Commander Peary's trip was not a lecture tour, but was made in response to many invitations from geographical and scientific societies abroad who desired to hear his personal story of the discovery of the North Pole. It was impossible in the brief time to accept the invitations of all the societies, but eleven capitals were visited. Commander Peary gave his first European address in London before the Royal Geographical Society, which provided an enthusiastic audience of 10,000 people. The illness of King Edward prevented his attendance, and his death a few days later also prevented the presence of Emperor William at the Berlin lecture.

Every Society conferred its highest honors upon Commander Peary, in Rome the King Humbert Gold Medal of the Royal Italian Geographical Society being presented in person by the King of Italy. In Edinburgh, besides receiving a special trophy from the Royal Scottish Geographical Society, the degree of LL.D. was conferred upon him by the old University of Edinburgh.

We print below the addresses of the Presidents of the Royal Geographical Society of London and of the Geographical Society of Berlin, which are typical of the unanimous respect and tribute paid in Europe to our great American explorer.

ADDRESS OF THE PRESIDENT OF THE ROYAL GEOGRAPHICAL SOCIETY OF LONDON; DR LEONARD DARWIN, IN PRESENTING THE SPECIAL GOLD MEDAL OF THE SOCIETY.

"Commander Peary was awarded our gold medal twelve years ago, which is sufficient proof that he is an Arctic traveler of the highest reputation, and his efforts have been marked by such splendid persistency as to make success appear to be the inevitable result.

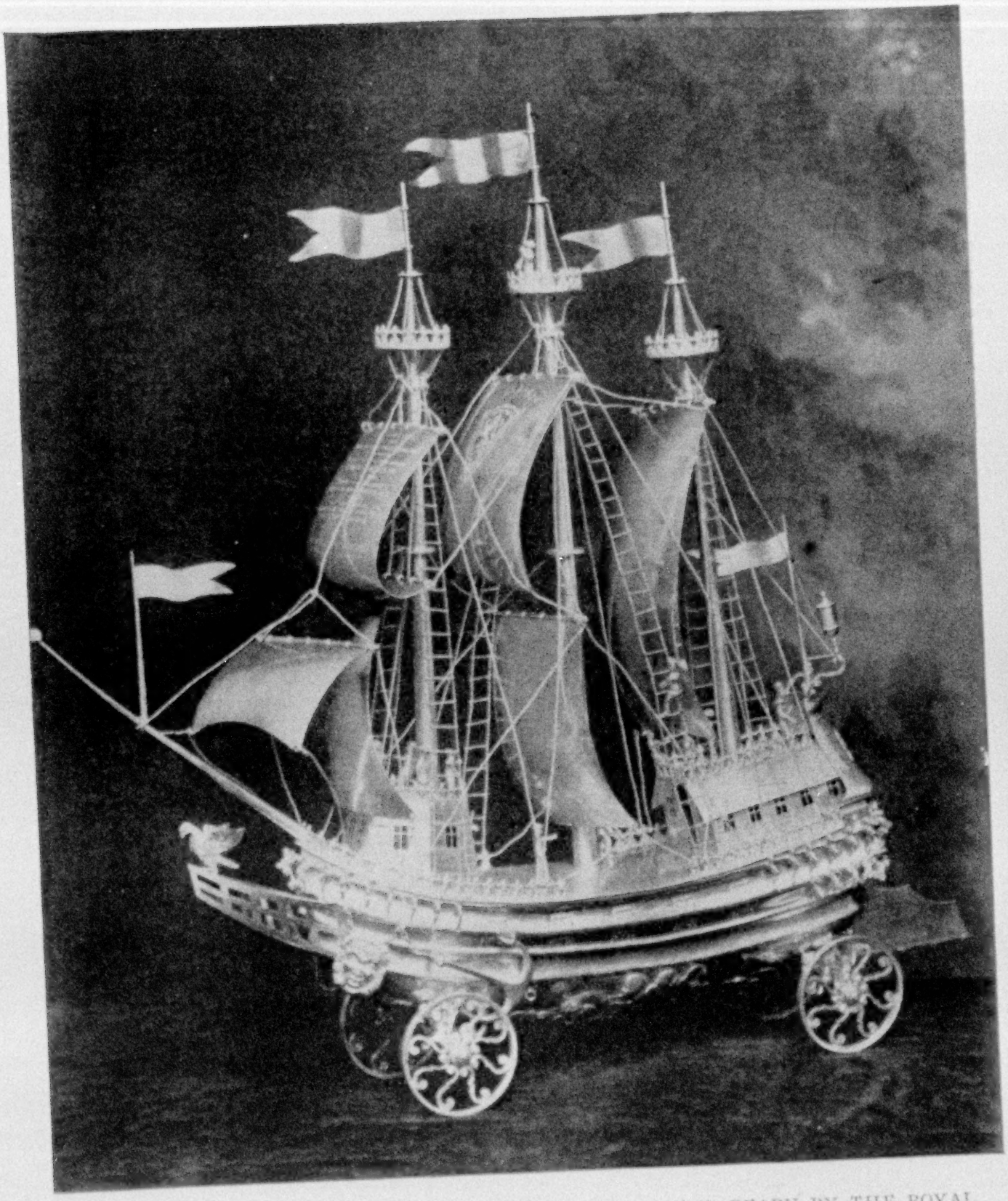
"An exceptionally capable committee of his fellow-countrymen, appointed by the National Geographic Society of America, have examined his original records, and have emphatically indorsed his claim. This judicial task could not have been more appropriately placed.

"It is on these grounds that, armed with the full authority of the Council of the Royal Geographical Society, I welcome Commander Peary as the first and only human being who has ever led a party of his fellow-creatures to a pole of the earth.

"We are not alone concerned with that aspect of Arctic exploration, for, in the course of the many arduous journeys, full of dangers and difficulties, which explorers have made when dragged northward by the lodestone of the Pole, a large amount of scientific work has been done and geographical knowledge has been greatly increased. Commander Peary's expeditions form no exception to this honorable record, and this should not be forgotten, because it has been the policy of the Society not to honor any mere race for the pole."

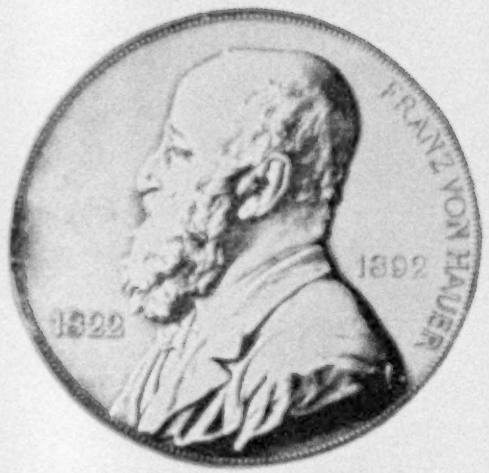
DR ALBRECHT PENCK, PRESIDENT OF THE GEOGRAPHICAL SOCIETY OF BERLIN, IN PRESENTING THE NACHTIGAL GOLD MEDAL OF THE SOCIETY.

"The members of this meeting have just stated by their great applause what living interest they take in the speaker's report of his expedition of the North Pole. This interest is based in the first place on the sentiment which President Roosevelt expressed when giving to our speaker, three and a half years ago, the Hubbard Medal of the National Geographic Society of America. He mentioned at that time that the firm basis of successful national characters are the fighting qualities of mankind, but that these qualities could not only be demonstrated in war, but also in peace, and that



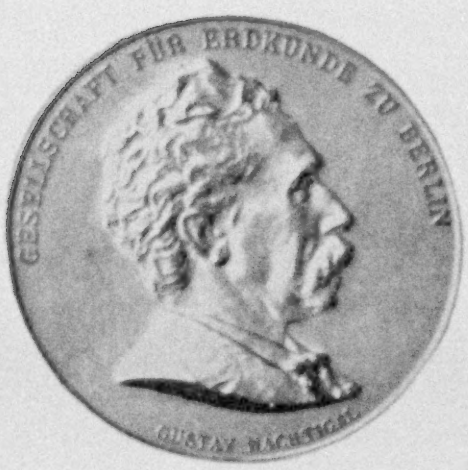
THE SILVER SHIP WHICH WAS PRESENTED TO ROBERT E. PEARY BY THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY OF EDINBURGH, MAY 24, 1910

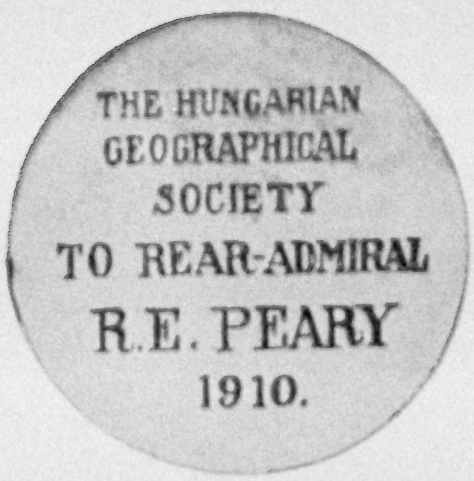
The ship is made entirely of silver, and weighs over 100 ounces. It stands about two feet in height and is mounted on four wheels. This Society had awarded its silver medal to Commander Peary in 1897 for crossing the ice cap of Greenland, and its gold medal to him in 1903 for his Arctic explorations during the preceding four years (see page 540).

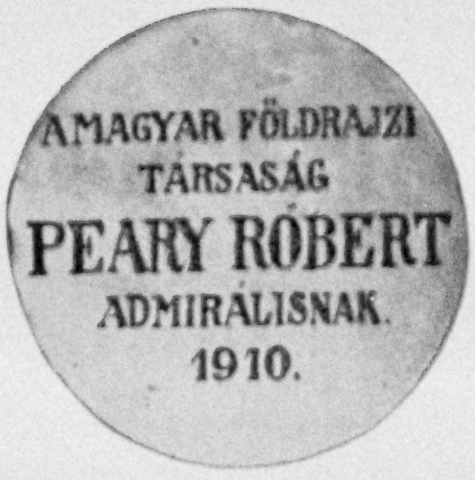


Courtesy New York Times. Copyright, 1910

1. The Gold Medal of the Imperial Austrian Geographical Society, Vienna.
2. The Gold Medal of the Royal Belgian Geographical Society, Brussels.
3. The King Humbert Gold Medal of the Royal Italian Geographical Society, Rome, which was presented by the King of Italy.
4. The Gold Medal of the Royal Geographical Society of Antwerp.







Courtesy New York Times. Copyright, 1910

1. The Special Gold Medal of the Royal Geographical Society of London, designed by the wife of Captain Robert F. Scott, R. N., leader of the British South Polar Expeditions of 1901–1904 and 1910–1912.

2. The Nachtigal Gold Medal of the Gesellschaft fur Erdgunde of Berlin (Geographical Society of Ber'in).

3. The Gold Medal of the Hungarian Geographical Society, the first and only gold medal ever awarded by this Society.

THE SPECIAL GOLD MEDAL OF THE NATIONAL GEOGRAPHIC SOCIETY, PRESENTED TO COMMANDER PEARY DECEMBER 15, 1909

The medal is four inches in diameter

it is of a special value to effect such qualities during a time of peace, when naturally a tendency to a weakening of the audacious powers is evident.

"We are sure that Commander Peary is one of those heroes disposed to fight, who, with never tiring activity and perseverance and using all their powers, are pushing forward in order to attain a great and difficult aim. But we feel more than that; we think of the enlargement of our knowledge of the globe, due to his courageous deeds.

"The New York Chamber of Commerce, which appointed him honorary member, was right in saying that the success of his last expedition was based neither on luck nor on bravery nor patience, but on experience, gathered by him during a man's life of ardent labor devoted to the exploration of the North Pole. Considering these merits, we celebrate not only the hero who reached the pole, but also the explorer who discovered a great part of the polar regions."

THE SILVER SHIP

At Edinburgh, at the conclusion of the address to the Royal Scottish Geographical Society, Lord Balfour of Burleigh presented to Commander Peary a silver model of a ship such as was used by illustrious Arctic navigators in the olden times. The ship is a copy of a three-masted vessel in full sail, such as was in use in the latter part of the sixteenth century. The model is a beautiful specimen of the silversmith's art. On one of the sails is engraved the badge of the Royal Scottish Geographical Society, while another bears the inscription in Latin from the pen of Mr W. B. Blaikie, which, translated, is as follows:

"This model of a ship, such as was used by John Davis, Henry Hudson, and William Baffin, illustrious Arctic navigators of the olden time, has been presented by the Royal Scottish Geographical Society as an evidence of its congratulation, admiration, and recognition to Robert Edwin Peary, American citizen, an explorer of the frozen Arctic, not less daring than his daring predecessors, who was the first to attain to that thrice-noble goal so long sought by innumerable bold mariners, the North Pole. Edinburgh, May 24th, 1910."

BOOK REVIEWS

Japanese Goldfish. By Dr Hugh M. Smith, Deputy U. S. Commissioner of Fisheries. Many illustrations and 10 colored plates. Washington, D. C.: W. F. Roberts & Co. Price, $2.00 *net.*

Dr Smith, well known to the readers of the NATIONAL GEOGRAPHIC MAGAZINE, is one of the world's foremost authorities on fishes, and his volume on Japanese Goldfishes is the result of a close study of the subject and will be regarded as an authority. The plates of the goldfish are splendid reproductions in natural colors and the book can be recommended in the highest terms. J. O. L.

The Gateway to the Sahara. By Charles Wellington Furlong. Pp. 300, 6½ x 8½. 35 illustrations and 3 maps. New York: Charles Scribner's Sons.

By word and picture the author, a well-known traveler, gives an insight into the most native of the Barbary capitals, its odd and fascinating customs and industries, and a view of those strange and interesting people who inhabit Tripolitania. It was Mr. Furlong who, in 1904, discovered the wrecked hull of the United States frigate *Philadelphia* below the waters of Tripoli harbor, and the book gives the dramatic episode of the vessel's destruction and finding a hundred years later.

J. O. L.

London Town, Past and Present. By W. W. Hutchins, with a chapter on the Future of London by Ford Madox Hueffer. 2 vols. Pp. 1130, 8¼ x 8½. Several hundred illustrations. New York: Cassell & Company. Price, $6.00 *net.*

No work of greater importance, or one more likely to hold a permanent place, than "London Town, Past and Present," has yet been published. It is unique, comprehensive, and of marked value. It limits itself to no one period of time or to no one part of the capital, and discusses no abstruse or antiquarian questions. It recounts in vivid language all the important and arresting events from Roman times to the present day. Mr. Ford Madox Hueffer, in a clever and suggestive chapter, essays to lift a corner of the veil behind which is hidden the future of London, and presents, in characteristically rich and pregnant diction, some ingenious speculations on that theme. J. O. L.

Women of All Nations. Edited by T. Athol Joyce and N. W. Thomas. 2 vols. Pp. 772, 8¼ x 8½. Several hundred illustrations and series of color plates. New York: Cassell & Co. Price, $12.00 *net.*

"Women of All Nations" is an authoritative work by such men as the late Prof O. T. Mason, Dr Grumberg, Archibald Colquhoun, and others, being a record of the characteristics, habits, manners, customs, and influence of women ranging from the toilette of the Parisienne down to the scanty skirt of the Fijian belle. The volumes give in word and splendid picture the psychological characteristics of the women of every race. You may read how the gentler sex of China, Samoa, India, or Sweden live and work, together with their curious forms of courtship and marriage. The volumes are illustrated with a collection of rare photographs gathered from every part of the world.

J. O. L.

Hunting In British East Africa. By Percy C. Madeira. Pp. 290, 6½ x 9. 130 illustrations and 2 maps. Philadelphia: J. B. Lippincott Co.

A very interesting narrative from the pen of a big game hunter telling of his experience in that sportsman's paradise, British East Africa. Starting with the initial arrangements for the big game hunt, the reader is taken step by step through the wildness of jungle and plain into the heart of the animal kingdom and hardly realizes the study of natural history he is absorbing so graphic is Mr. Madeira's story. The illustrations, actual photographs, are very fine and the maps comprehensive. J. O. L.

Wanderings In the Roman Campagnia. By Rodolfo Lanciani. Pp. 370, 7½ x 9½. 112 illustrations. Boston: Houghton, Mifflin Co.

Camp and Camino in Lower California. By Arthur Walbridge North, with introduction by Rear Admiral Robley D. Evans, U. S. N. Pp. 346, 7⅛ x 9⅛. 32 illustrations and 2 maps. New York: The Baker & Taylor Co. Price, $3.00 *net.*

A book of adventure and exploration in Lower California, a land of desert and mountains. Few regions on the globe are less known than this country at our very door. The volume contains much that is fascinating along the lines of hunting and adventure, at the same time giving valuable description and records of scientific exploration. J. O. L.

The Great Pacific Coast. By C. Reginald L. Enock. Pp. 356, 6¼ x 9. 63 illustrations and several maps. New York: Charles Scribner's Sons. Price, $4.00 *net.*

The book from the pen of this well-known writer on Latin American subjects is rather unique, treating as it does for the first time of the vast region of the Pacific Coast of North and South America as a physical and political entity. Seen from the viewpoint of an experienced traveler, the subject is one of great interest, and especially fine are the photographic illustrations. J. O. L.

Soil Fertility and Permanent Agriculture. By Cyril G. Hopkins. Pp. 650, 6 x 8½. Numerous maps and tables. Boston: Ginn & Co.

The book is written primarily for American land-owners, who must either think and plan for the preservation of the land or allow its

more extended ruin, and secondarily for other students of agriculture and economics, whether in the lecture-room or in the business world.

Geographical Essays. By William Morris Davis. Edited by Douglas William Johnson. Pp. 777, 8 x 5½. Boston: Ginn & Co. 1909.

This is a reprint, in permanent form, of certain of the geographical papers of Professor Davis. As the editor says in his introductory note, they are reprinted without change, except that a few minor modifications have been made in style, and in a few cases, material modifications have been made to bring the matter into accord with recent discoveries. Of the twenty-six Essays which are here reprinted, the first twelve are educational, the remainder being physiographic in character. Three of the latter were originally published in this Magazine. H. G.

Descriptive Meteorology. By Willis L. Moore, LL. D., Sc. D. Pp. 344. 6 x 9. Illustrated. New York and London: D. Appleton & Co. 1910.

In his introduction, Professor Moore characterizes the *raison d'etre* for this book as follows:

"To provide, as far as possible, the young men entering the service of the U. S. Weather Bureau with a comprehensive introduction to modern meteorology. But to meet their needs in this particular is to provide equally well for all others who are beginning seriously this important science."

The work is divided into fifteen chapters, and a summary of its contents can perhaps best be given by an enumeration of their subjects, as follows:

The atmospheres of the earth and of the planets.
Atmospheric air.
Micro-organisms and dust motes of the air.
Physical condition of the sun, and its relation to the earth's atmosphere.
Heat, light, and temperature.
Thermometry.
Distribution of insolation and the resulting temperatures of the atmosphere, the land and the water.
The isothermal layer.
Atmospheric pressure and circulation, winds, clouds.
Precipitation.
Forecasting the weather.
Optical phenomena.
Climate.

The first four chapters deal to a large extent with matters only slightly related to meteorology, and might well be greatly condensed. To a less extent this is also true of the fifth chapter—that on heat, light, and temperature. The chapter on thermometry is devoted to a description of instruments and their installation. The next, on insolation, has a broad scope, including the distribution of temperature on land and water areas, its distribution in depth, both in the soil and water, its vertical distribution in the atmosphere, its distribution with latitude, etc.

The chapter on the isothermal layer sums up the results from a vast number of soundings of the upper atmosphere by means of balloons and kites. That on atmospheric pressure begins by describing the instruments used in its measurement. This is followed by an account of the general distribution of pressure over the earth, the general air movements, local movements, cyclonic movements, etc. This subject is concluded in the next chapter, that on winds, in which is included a description of the instruments used in measuring the direction and velocity of air currents. The chapter on clouds is brief, including their classification, formation, height, etc.

Precipitation is treated fully in all its forms, as to cause, distribution in time and space, modifying influences, etc., even to attempts to produce it artificially.

The application of much of what precedes is made in the next chapter, that on "Forecasting the Weather," being a description of the methods employed in this work in the Weather Bureau. Incidental to this are descriptions and explanations of many different phenomena of weather.

Optical phenomena include color of sky, coronas, rainbows, halos, mock suns, etc.

The final chapter defines climate as the average weather of a locality. It enumerates the meteorological data which constitute climate and the factors which modify and control them, such as latitude, altitude, topography, etc. Certain typical climates are described and their effects on the human race are characterized.

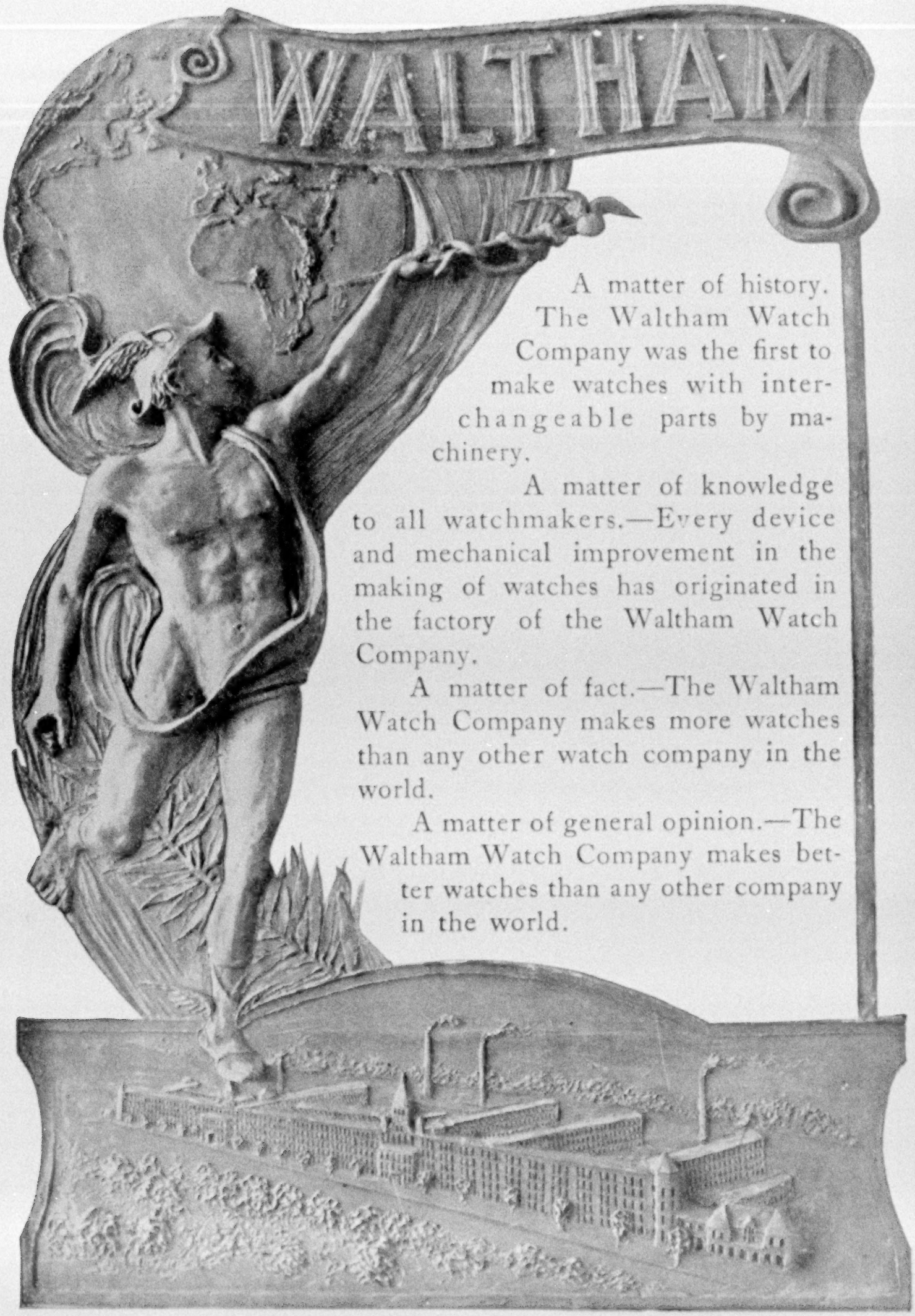
In the above attempt to summarize the contents of the book it must be understood that it is possible to hit only the high places, as the number of topics discussed is very great.

The matter is well arranged and the book is *readable*, a most excellent, though rare, quality in works on this subject. It is fully illustrated with maps and diagrams.

At the end of each chapter is a list of books treating on the subject-matter of that chapter.

Altogether this is a most comprehensive and excellent text-book on its subject. H. G.

Across the Sahara from Tripoli to Bornu. By Hanns Vischer, with foreward by Sir Harry Johnston. Pp. 304, 6½ x 9. 45 illustrations and map. New York: Longmans, Green & Co. Price, $3.50 *net*.



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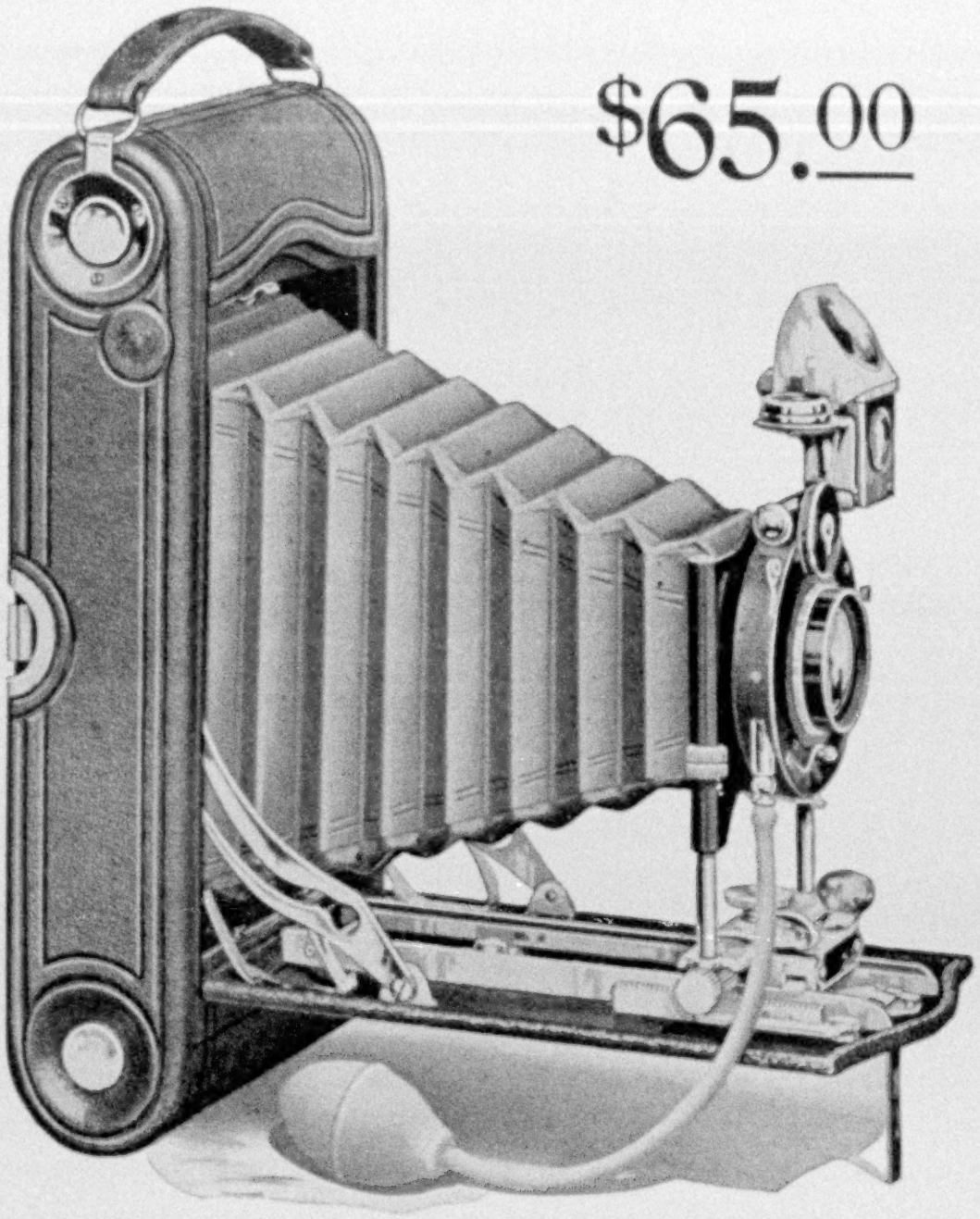

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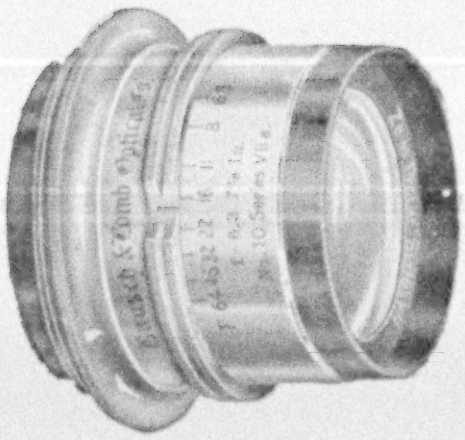

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is a most interesting contribution to the ever-present discussion of the relations between Germany and England.

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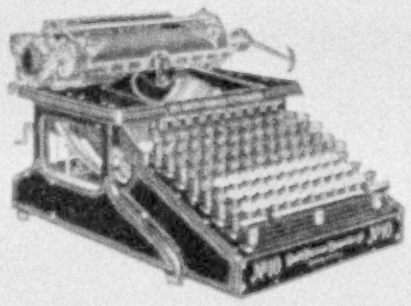

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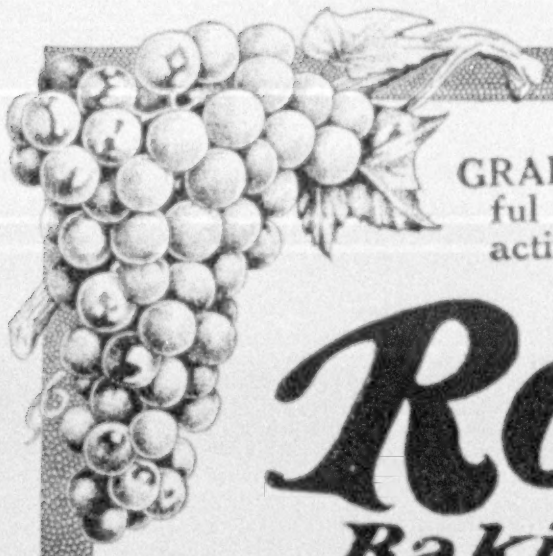

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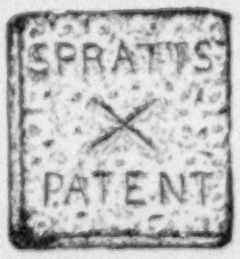

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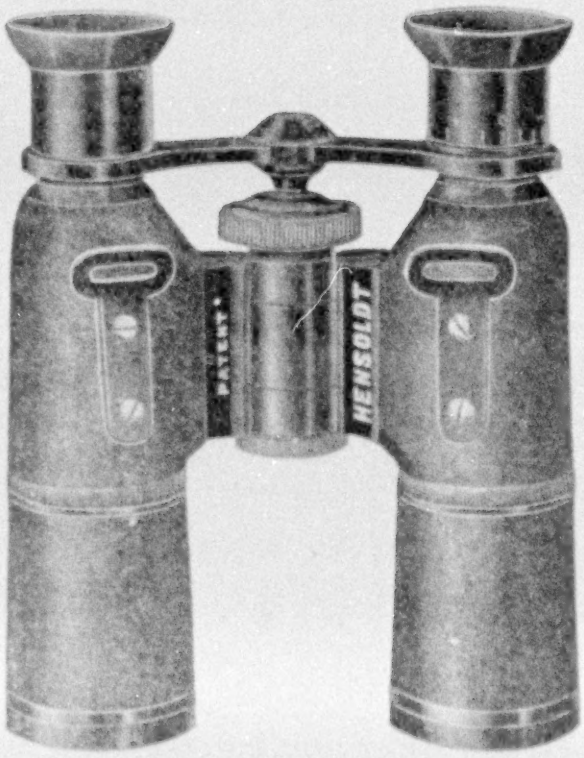

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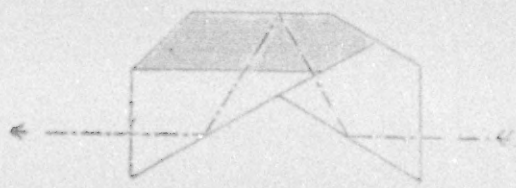

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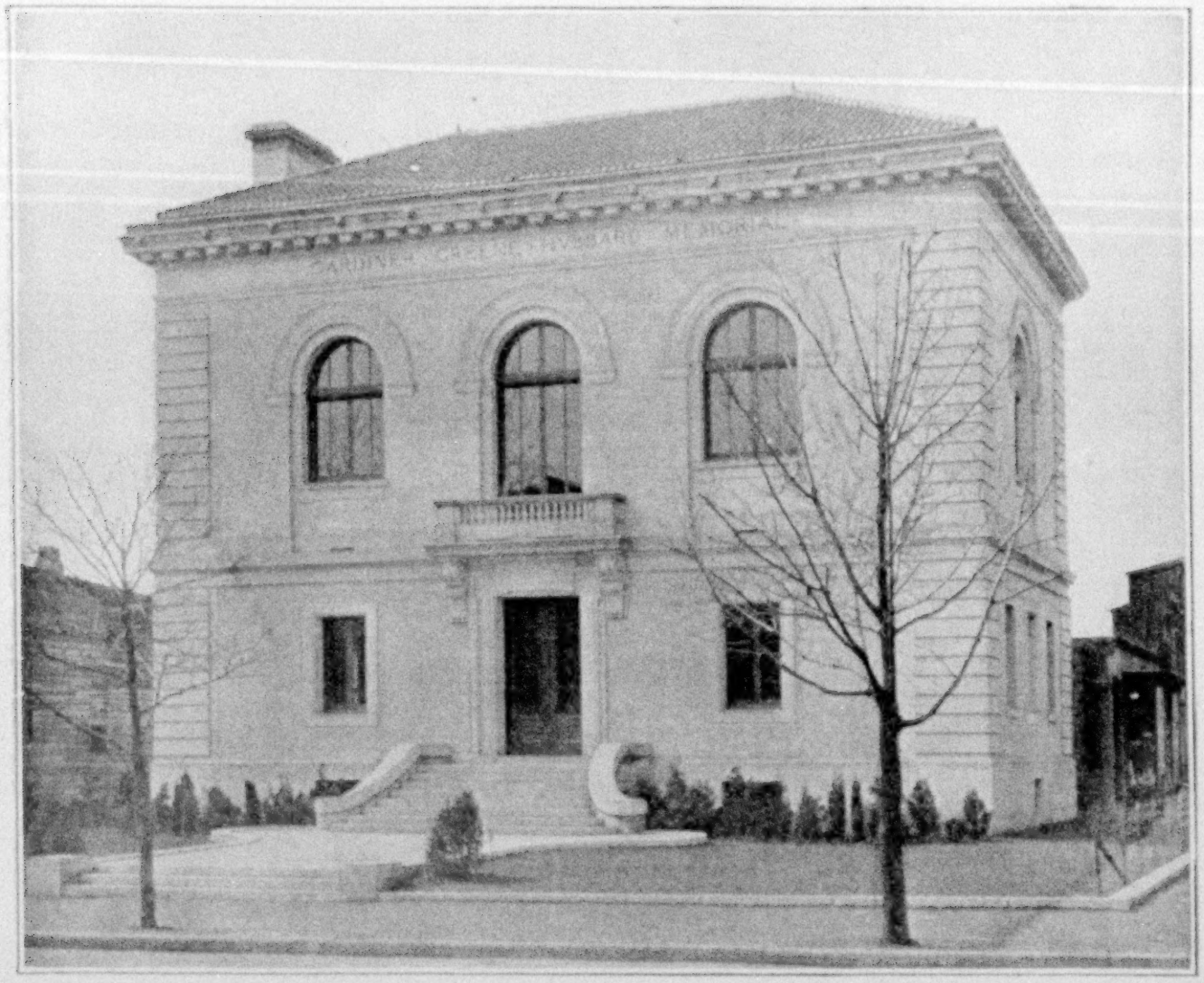

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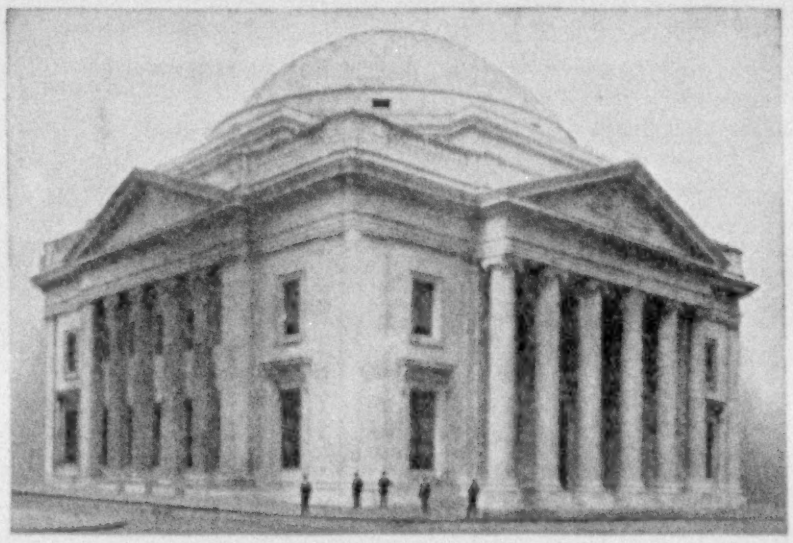

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